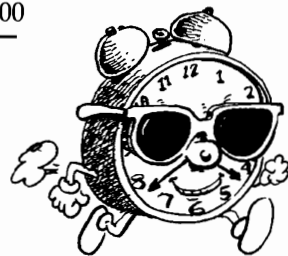
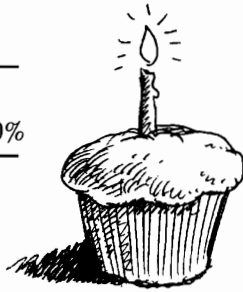


29. The first 12 contestants won an average of \$80. The next 20 won an average of \$70. The 32 contestants won an average of
A) \$73.75 B) \$74.75 C) \$75.00 D) \$75.75
30. $4^3 \times 4^3 =$ A) 16^9 B) 16^6 C) 4^9 D) 4^6
31. At most ? circles of radius 1 with non-overlapping interiors can fit inside a square with side-length 4.
A) 1 B) 4 C) 5 D) 16
32. $0.1\% = 1\% - ?$
A) 0.009% B) 0.09% C) 0.9% D) 10%
33. Today is my birthday. My age today, in months, is 72 times my age 5 years ago, in years. My age today, in years, is
A) 6 B) 7 C) 8 D) 12
34. $\sqrt{\sqrt{81 \times 81 \times 81 \times 81}} =$
A) 3 B) 9 C) 27 D) 81
35. Of 2005 integers whose product is even, at most ? can be odd.
A) 2005 B) 2004 C) 1 D) 0
36. The number ? equals one-fourth of its own reciprocal.
A) $\frac{1}{2}$ B) $\frac{1}{4}$ C) 2 D) 4
37. How many of the numbers 11, 21, 31, 41, 51, 61, 71, 81, 91 are prime?
A) 4 B) 5 C) 6 D) 7
38. $(301+302+303+\dots+325) - (1+2+3+\dots+25) =$
A) 25 B) 2500 C) 5000 D) 7500
39. Of the following, which is the first time after 4:30 that the minute and hour hands of my circular alarm clock *no longer* form an acute angle?
A) 4:36 B) 4:37 C) 4:38 D) 4:39
40. Consecutive letters of the alphabet, starting with A, are given increasing consecutive integer values. If $H+K+L+N = 2005$, then the average of all 26 of the consecutive integers is
A) 491 B) 498 C) 503.5 D) 505.5



The end of the contest 7

Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors



Sample 7th Grade Contest

Tuesday, February 22 (alternate date: February 15), 2005

7

Instructions

- **Time** Do *not* open this booklet until you are told by your teacher to begin. You will have only 30 minutes working time for this contest. You might be *unable* to finish all 40 questions in the time allowed.
- **Scores** Please remember that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 30 points (75% correct). Students with half that, 15 points, *should be commended!*
- **Format, Point Value, & Eligibility** This is a multiple-choice contest. Every answer is an A, B, C, or D. You must write each answer in the *Answers* column to the right of each question. We suggest (but do not require) that you use a pencil. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you’re in grade 7 or below and only if you don’t also take this year’s *Annual 8th Grade* or *Annual 6th Grade Contest*.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Time at Start of Contest _____ Today’s Date _____

Do Not Write In The Space Below

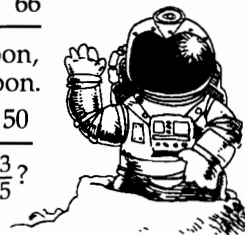
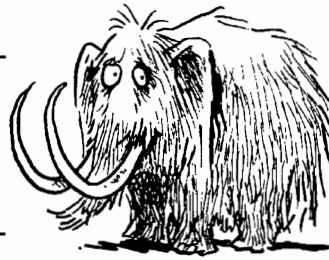
To the Teacher:

Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.*

Student’s Score: _____

Fifteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5)*, and *High School (Vols. 1, 2, 3, 4, 5)*, are available, for \$12.95 per volume (\$15.95 Canadian), from Math League Press, P.O. Box 17, Tenafly, N.J. 07670-0017.

1. If 84 players split themselves into teams, how many more teams can they form by splitting into teams of 4 instead of teams of 6? A) 5 B) 6 C) 7 D) 14	1.
2. $0 \times 1 + 1 \times 10 + 0 \times 0 + 1 =$ A) 0 B) 1 C) 3 D) 11	2.
3. The three angles of a triangle can measure 20° , 40° , and A) 60° B) 80° C) 90° D) 120°	3.
4. To the nearest tenth, $3456 \times 0.001 =$ A) 0.3 B) 3.4 C) 3.5 D) 34.6	4.
5. If my bad hair day began 720 minutes before 7:20 P.M., then my bad hair day began at A) 1:20 A.M. B) 7:20 A.M. C) 12:00 P.M. D) 7:08 P.M.	5.
6. $500 + 500 + 500 + 500 + 500 = 10 \times ?$ A) 25 B) 50 C) 250 D) 2000	6.
7. Of the whole numbers 10, 11, . . . , 98, 99, how many are greater than the sum of their digits? A) 88 B) 89 C) 90 D) 99	7.
8. $1^3 + 2^4 =$ A) $1^4 + 3^2$ B) $1^3 + 4^2$ C) $1^2 + 4^3$ D) $1^1 + 3^4$	8.
9. 7 is prime, so May 7th is a <i>prime</i> day. In all, May has ? prime days. A) 10 B) 11 C) 12 D) 13	9.
10. $\frac{2}{3} \times \frac{4}{5} \times \frac{6}{7} \times \frac{7}{6} \times \frac{5}{4} \times \frac{3}{2} =$ A) 1 B) 3 C) 6 D) 12	10.
11. 500 nickels = ? quarters A) 100 B) 250 C) 500 D) 2500	11.
12. If a square's side-lengths are integers, its perimeter could be A) 33 B) 44 C) 55 D) 66	12.
13. If 3 of every 150 astronauts walk on the moon, then ?% of all astronauts walk on the moon. A) 2 B) 3 C) 5 D) 50	13.
14. Of the following, which <i>doesn't</i> reduce to $\frac{3}{5}$? A) $\frac{9}{15}$ B) $\frac{21}{35}$ C) $\frac{24}{40}$ D) $\frac{33}{50}$	14.
15. $\sqrt{100} = \sqrt{36} + \sqrt{?}$ A) 2 B) 4 C) 16 D) 64	15.



16. ? can be made from 2 squares that share a common side. A) An octagon B) A hexagon C) A rectangle D) A triangle	16.
17. By how much does the sum $19 + 28 + 37 + 46 + 55 + 64 + 73 + 82 + 91$ exceed the sum $18 + 27 + 36 + 45 + 54 + 63 + 72 + 81 + 90$? A) 9 B) 10 C) 90 D) 100	17.
18. Uncle Bookworm eats two books a week; Aunt Bookworm eats one book every two months. In a year, Uncle eats ? more books than Aunt. A) 20 B) 40 C) 80 D) 98	18.
19. What is the largest odd factor of 81? A) 3 B) 9 C) 27 D) 81	19.
20. $(\frac{2}{3})^3 =$ A) 2 B) $\frac{6}{9}$ C) $\frac{8}{3}$ D) $\frac{8}{27}$	20.
21. <i>At most</i> how many students can sit in a row of 25 chairs, if seated students must be separated by at least one empty chair? A) 11 B) 12 C) 13 D) 24	21.
22. The smallest multiple of 10 that's greater than 9×9 is A) $9 \times 9 + 10$ B) 9.1×9.1 C) 9×10 D) 10×10	22.
23. The difference between $\frac{5}{6}$ and its reciprocal is A) $\frac{1}{5}$ B) $\frac{1}{6}$ C) $\frac{1}{30}$ D) $\frac{11}{30}$	23.
24. On my scooter, the rear wheel's diameter is 6 cm more than the front wheel's. The rear wheel's circumference is ? cm more than the front wheel's. A) 3π B) 6π C) 9π D) 36π	24.
25. A regular polygon is always A) square B) equilateral C) scalene D) isosceles	25.
26. If I divide my age by 5, the remainder is 3. Your age is twice mine. If I divide your age by 5, the remainder will be A) 1 B) 2 C) 3 D) 4	26.
27. In a rectangle with perimeter 30 cm and area 56 cm^2 , the longer side's length is ? cm more than that of the shorter side. A) 1 B) 5 C) 20 D) 26	27.
28. If the sum of two whole numbers is 24 more than their difference, then one of the numbers <i>must</i> be A) 0 B) 6 C) 12 D) 48	28.



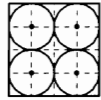
29. The 1st 12 won $12 \times \$80 = \960 . The next 20 won $20 \times \$70 = \1400 . The 32 contestants won an average of $\$2360 \div 32 = \73.75 .
 A) \$73.75 B) \$74.75 C) \$75.00 D) \$75.75

29.
A

30. $4^3 \times 4^3 = 4^{3+3} = 4^6$.
 A) 16^9 B) 16^6 C) 4^9 D) 4^6

30. D

31. 4 such circles fit inside a square of side-length 4.
 A) 1 B) 4 C) 5 D) 16



31.
B

32. Just as $1 - 0.9 = 0.1$, $0.1\% = 1.0\% - 0.9\%$.
 A) 0.009% B) 0.09% C) 0.9% D) 10%

32.
C

33. Change each answer choice to months. Since 6 years = 72 months, and 5 years ago I was 1 year old, choice A is correct.
 A) 6 B) 7 C) 8 D) 12



33.
A

34. $\sqrt{81 \times 81 \times 81 \times 81} = \sqrt{81^4} = 81^2$, so $\sqrt{\sqrt{81 \times 81 \times 81 \times 81}} = \sqrt{81^2} = 81$.
 A) 3 B) 9 C) 27 D) 81

34.
D

35. If a product is even, at least 1 factor must be even.
 A) 2005 B) 2004 C) 1 D) 0

35.
B

36. $1/2$ is one-fourth of 2, its reciprocal, so choice A is correct.
 A) $\frac{1}{2}$ B) $\frac{1}{4}$ C) 2 D) 4

36.
A

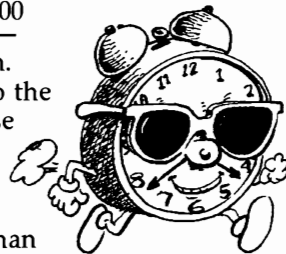
37. $21 = 3 \times 7$; $51 = 3 \times 17$; $81 = 3 \times 27$; $91 = 7 \times 13$. Other 5 are prime.
 A) 4 B) 5 C) 6 D) 7

37.
B

38. $(301-1) + (302-2) + \dots + (325-25) = (300) \times 25 = 7500$.
 A) 25 B) 2500 C) 5000 D) 7500

38.
D

39. Angle at 4:30 is 45° . Each min., the min. hand moves 6° , hr. hand moves 0.5° , so the angle increases 5.5° . The 8-min. increase is 44° , so the angle at 4:38 is only 89° .
 A) 4:36 B) 4:37 C) 4:38 D) 4:39



39.
D

40. If $H+K+L+N = 2005$, then H is less than $2005 \div 4 = 501.25$. If $H = 498$, $H+K+L+N = 498+501+502+504 = 2005$. Since M and N are the middle of the alphabet, the average of all 26 letters is $(503+504) \div 2 = 503.5$.
 A) 491 B) 498 C) 503.5 D) 505.5

40.
C

The end of the contest 7

Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors

Information & Solutions

2004-2005 Annual 7th Grade Contest

Tuesday, February 22 (alternate date: February 15), 2005

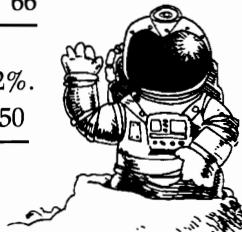
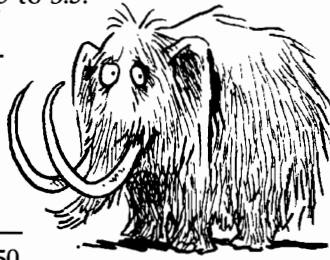
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
Directions for Grading

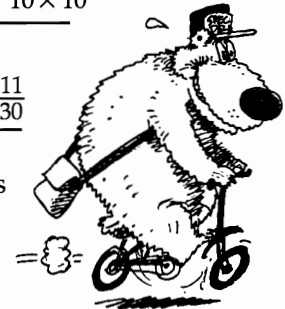
- **Security and Solutions** Do not look at these solutions until after the contest. Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- **Urgent questions?** Call 1-201-568-6328.
- **Scores** Please remember that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 30 points (75% correct). Students with half that, 15 points, *should be commended!*
- **Awards & Results** The original contest package contained 5 *Certificates of Merit*—1 each for the highest scoring student on each grade level, plus extras for ties. Do you need more *Certificates of Merit*? If so, include your name, school, and school mailing address in a letter to: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**, and include a self-addressed, stamped envelope (2 stamps required) large enough to hold certificates. Only score reports postmarked by Fri., Feb. 25, 2005, and received by Tues., Mar. 9, 2005 can be used in our *Summary of Contest Results* newsletter, which you’ll receive no later than Tues., May 10, 2005.
- **Return of Student Papers** *Originals* of contest papers with scores of 30 or more *must* be held until June 1. *Copies* of these papers, and originals of all other papers, should be returned to students after grading. Students scoring 30 points or more must confirm an *understanding* of the contest rules by signing the *Selected Math League Rules* (on the colored sheet of information and rules that accompanied the contests). Keep this signed sheet with the original contests until June 1. Please do not mail these to the League unless we ask you to do so.

Fifteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5)*, and *High School (Vols. 1, 2, 3, 4, 5)*, are available, for \$12.95 per volume (\$15.95 Canadian), from Math League Press, P.O. Box 17, Tenafly, N.J. 07670-0017.

1. 84 players can split into $84 \div 6 = 14$ teams of 6 players and $84 \div 4 = 21$ teams of 4 players. There are 7 more teams of 4. A) 5 B) 6 C) 7 D) 14	1. C
2. $(0 \times 1) + (1 \times 10) + (0 \times 0) + 1 = 0 + 10 + 0 + 1 = 11$. A) 0 B) 1 C) 3 D) 11	2. D
3. The sum is 180° . The 3rd angle must be $180^\circ - (20^\circ + 40^\circ) = 120^\circ$. A) 60° B) 80° C) 90° D) 120°	3. D
4. $3456 \times 0.001 = 3.456$. This rounds up to 3.5. A) 0.3 B) 3.4 C) 3.5 D) 34.6	4. C
5. Since $720 \text{ minutes} = (720 \div 60) \text{ hours} = 12 \text{ hours}$, my bad hair day began at 7:20 A.M. A) 1:20 A.M. B) 7:20 A.M. C) 12:00 P.M. D) 7:08 P.M.	5. B
6. The sum = $5 \times 500 = 2500 = 10 \times 250$. A) 25 B) 50 C) 250 D) 2000	6. C
7. Since every number on the list is greater than the sum of its digits, all 90 numbers are greater than the sum of their digits. A) 88 B) 89 C) 90 D) 99	7. C
8. $1^3 + 2^4 = 17 = 1^3 + 4^2$. A) $1^4 + 3^2$ B) $1^3 + 4^2$ C) $1^2 + 4^3$ D) $1^1 + 3^4$	8. B
9. There are 11 prime days in May: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, and 31. A) 10 B) 11 C) 12 D) 13	9. B
10. $(\frac{2}{3} \times \frac{3}{2}) \times (\frac{4}{5} \times \frac{5}{4}) \times (\frac{6}{7} \times \frac{7}{6}) = 1 \times 1 \times 1 = 1$. A) 1 B) 3 C) 6 D) 12	10. A
11. Since 5 nickels = 1 quarter, 500 nickels = 100 quarters. A) 100 B) 250 C) 500 D) 2500	11. A
12. All side-lengths are equal, so the perimeter is divisible by 4. A) 33 B) 44 C) 55 D) 66	12. B
13. 3 of every 150 is the same as 1 of every 50. That's the same as 2 of every 100, which is 2%. A) 2 B) 3 C) 5 D) 50	13. A
14. $\frac{33}{50}$ cannot be reduced. A) $\frac{9}{15}$ B) $\frac{21}{35}$ C) $\frac{24}{40}$ D) $\frac{33}{50}$	14. D
15. $\sqrt{100} = \sqrt{36} + \sqrt{7} \Leftrightarrow 10 = 6 + \sqrt{7}$, so $4 = \sqrt{7} = \sqrt{16}$. A) 2 B) 4 C) 16 D) 64	15. C



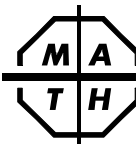
16. As shown, 2 squares with a common side form a rectangle.  A) An octagon B) A hexagon C) A rectangle D) A triangle	16. C
17. Each of the 9 numbers in the first sum is 1 more than the number in the same position in the second sum. A) 9 B) 10 C) 90 D) 100	17. A
18. Uncle Bookworm eats 2 books a week, or 104 a year. Aunt Bookworm eats 1 book every 2 months, or 6 a year. Uncle eats $104 - 6 = 98$ more books than Aunt. A) 20 B) 40 C) 80 D) 98	18. D
19. The largest odd factor of 81 is 81. A) 3 B) 9 C) 27 D) 81	19. D
20. $(\frac{2}{3})^3 = \frac{2 \times 2 \times 2}{3 \times 3 \times 3} = \frac{8}{27}$. A) 2 B) $\frac{6}{9}$ C) $\frac{8}{3}$ D) $\frac{8}{27}$	20. D
21. To seat the most students, put the students in seats 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, and 25. That's 13 seated students. A) 11 B) 12 C) 13 D) 24	21. C
22. The smallest multiple of 10 that's greater than $9 \times 9 = 81$ is 90. A) $9 \times 9 + 10$ B) 9.1×9.1 C) 9×10 D) 10×10	22. C
23. $\frac{6}{5} - \frac{5}{6} = \frac{36}{30} - \frac{25}{30} = \frac{11}{30}$. A) $\frac{1}{5}$ B) $\frac{1}{6}$ C) $\frac{1}{30}$ D) $\frac{11}{30}$	23. D
24. The rear wheel's diameter is 6 cm more than the front wheel's. The rear wheel's circumference is $(d+6) \times \pi$ cm, which is 6π cm more than the front wheel's. A) 3π B) 6π C) 9π D) 36π	24. B
25. All sides of a regular polygon have equal lengths. A) square B) equilateral C) scalene D) isosceles	25. B
26. My age could be 8 and yours could be 16. When you divide 16 by 5, the remainder is 1. A) 1 B) 2 C) 3 D) 4	26. A
27. If a rectangle's perimeter is 30 cm, and its area is 56 cm^2 , then the longer side's length is 8 cm, and the shorter side's length is 7 cm. A) 1 B) 5 C) 20 D) 26	27. A
28. Try some numbers. One set that works is 12 and 13. (The sum always exceeds the difference by twice the smaller number.) A) 0 B) 6 C) 12 D) 48	28. C



<p>26. Wilma's potion needs 3 ingredients. Her choices are newt, fly, beetle, snake, and snail. How many different combinations of 3 of these 5 choices are there? A) 6 B) 8 C) 10 D) 60</p>	<p>26.</p>
<p>27. The sum of six consecutive integers <i>could</i> be A) 81 B) 88 C) 92 D) 98</p>	<p>27.</p>
<p>28. 288 minutes = <u>?</u> % of 1 day A) 10 B) 15 C) 20 D) 40</p>	<p>28.</p>
<p>29. Two cousins visited Jane today. One cousin visits every 42 days. The other visits every 429 days. They will next visit on the same day in <u>?</u> days. A) 4296 B) 6006 C) 9009 D) 18018</p>	<p>29.</p>
<p>30. $3^{2013} - 3^{2012} =$ A) 3^1 B) 3^{2011} C) 2×3^{2012} D) 6^{1006}</p>	<p>30.</p>
<p>31. The measure of the smaller angle formed by the hour and minute hands of a circular clock at 2:46 is A) 84° B) 137° C) 167° D) 174°</p>	<p>31.</p>
<p>32. The median of $\frac{1}{6}, \frac{2}{5}, \frac{3}{4}, \frac{4}{3}, \frac{5}{2}$, and $\frac{6}{1}$ is A) 1 B) $\frac{669}{360}$ C) $\frac{7}{12}$ D) $\frac{25}{24}$</p>	<p>32.</p>
<p>33. Brad mixes seeds to attract birds. His Blue mix is 55% sunflower and 45% bluegrass. His Rye mix is 30% sunflower and 70% ryegrass. His Master mix combines some of each of the Blue and Rye mixes. If Master mix is 45% sunflower, how much of each kg of Master mix is Blue mix? A) 350 g B) 400 g C) 600 g D) 650 g</p>	<p>33.</p>
<p>34. If I multiply all whole numbers from 1 through 100, the largest power of 4 that is a factor of the product is A) 4^{25} B) 4^{32} C) 4^{48} D) 4^{50}</p>	<p>34.</p>
<p>35. Of my books, 85% are new and the rest are used. Some are biographies, 70% of which are new. What is the ratio of the fraction of new books that are biographies to the fraction of used books that are biographies? A) 7:17 B) 14:17 C) 17:14 D) 17:7</p>	<p>35.</p>



The end of the contest 7



Sample 7th Grade Contest

Tuesday, February 26 (alternate date: February 19), 2013

7

Instructions

- **Time** Do *not* open this booklet until told by your teacher to begin. You might be *unable* to finish all 35 questions in the 30 minutes allowed.
- **Scores** Remember that *this is a contest, not a test*—there is no “passing” or “failing” score. Few students score 28 points (80% correct). Students with 14 points, *should be commended!* High-scoring students may be invited to our “Math Camp,” held last August at Stanford University.
- **Results Posted Online** Scores of high-scoring schools, both regional and overall, will be posted at www.mathleague.com no later than April 15.
- **Format, Point Value, & Eligibility** Every answer is an A, B, C, or D. Write answers in the *Answers* column. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you are in grade 7 or below and only if you don’t also take this year’s Annual 6th or Annual 8th Grade Contest.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____
 School _____ Teacher _____ Grade Level _____
 Time at Start of Contest _____ Today’s Date _____

Do Not Write In The Space Below

To the Teacher:

Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.* **Student’s Score:** _____



Eighteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6), Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6), and High School (Vols. 1, 2, 3, 4, 5, 6),* are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.


1. Of the following numbers, which is closest to 10.98? A) 10.00 B) 10.90 C) 10.95 D) 11.00	1.
2. $\sqrt{4 \times 9 \times 16} =$ A) 9 B) 24 C) 29 D) 36	2.
3. Mr. Barry is angry. He has 4 grubs left after he tried to divide 256 grubs equally among his cubs. There could be <u>?</u> cubs. A) 5 B) 6 C) 8 D) 11	3.
4. The tenths digit of <u>?</u> is larger than its hundredths digit. A) 543.21 B) 231.23 C) 654.56 D) 642.46	4.
5. $3^2 + 3^2 + 3^2 =$ A) 3^3 B) 3^6 C) 9^3 D) 9^6	5.
6. $3 \div \frac{1}{6} = 9 \div \underline{?}$ A) $\frac{1}{18}$ B) $\frac{1}{12}$ C) $\frac{1}{2}$ D) $\frac{9}{2}$	6.
7. The greatest common factor of 2013 and <u>?</u> is 11. A) 231 B) 365 C) 418 D) 542	7.
8. Three times a certain number is 36. One-third of that certain number is A) 4 B) 12 C) 36 D) 108	8.
9. If a case of eggs contains 12 dozen eggs, how many eggs are in two crates of 12 cases each? A) 48 B) 144 C) 288 D) 3456	9.
10. One hundred million divided by ten thousand equals A) 10 B) 100 C) 1000 D) 10000	10.
11. Ashley the chimney sweep puts his hat down on a square the same size as the opening of a chimney. The circular brim touches each side of the square at a single point. The perimeter of the square is 4 m. What is the radius of the circular brim of Ashley's hat? A) 0.5 m B) 1 m C) 2 m D) 4 m	11.
12. $\frac{1}{3} \times \frac{2}{4} \times \frac{3}{5} \times \frac{4}{6} \times \frac{5}{7} \times \frac{6}{8} \times \frac{7}{9} \times \frac{8}{10} = \frac{1}{10} \times \underline{?}$ A) $\frac{3}{19}$ B) $\frac{2}{9}$ C) $\frac{1}{9}$ D) $\frac{2}{90}$	12.
13. $20 + 30 + 40 -$ (the average of 20, 30, and 40) = A) 0 B) 45 C) 60 D) 90	13.



14. Del loves sandwiches so much that 130 of his last 250 meals were sandwiches. What percent of those last 250 meals were <i>not</i> sandwiches? A) 40% B) 44% C) 48% D) 52%	14.
15. The sum of the two least odd divisors of 120 is A) 4 B) 5 C) 8 D) 15	15.
16. I collect 20 seashells every 30 minutes, but I drop 3 shells every 2 hours. If I collect shells for 8 hours, I will end up with <u>?</u> shells. A) 68 B) 136 C) 296 D) 308	16.
17. The number of nickels in \$3.00 plus the number of dimes in \$6.00 is half the number of quarters in A) \$12.00 B) \$15.00 C) \$30.00 D) \$60.00	17.
18. 0.05% of 10 000 equals A) 5 B) 50 C) 500 D) 5 000	18.
19. The sum of 13 consecutive integers is 13. The greatest of the integers is A) 6 B) 7 C) 9 D) 13	19.
20. Apples cost 65¢ each and oranges cost 85¢ each. If I spend \$8.80 on apples and oranges, how many pieces of fruit did I buy all together? A) 11 B) 12 C) 13 D) 14	20.
21. Dragon Doug reads a prime number of books each month. If each prime is different, which of the following <i>cannot</i> be the total number of books he reads in 3 months? A) 10 B) 12 C) 13 D) 15	21.
22. The number halfway between 45 674 567 and 67 896 789 is A) 55 443 322 B) 55 556 666 C) 56 565 656 D) 56 785 678	22.
23. $\sqrt{49} - \sqrt{16} =$ A) $\sqrt{33}$ B) $\sqrt{25}$ C) $\sqrt{9}$ D) $\sqrt{3}$	23.
24. The greatest power of 3 that divides 2016^{2013} is A) 3^{2013} B) 3^{2015} C) 3^{4026} D) 3^{6039}	24.
25. A new spa opens for the first time on Wednesday, March 2. If it is open only on Monday through Friday each week, its 21st day open will be A) March 22 B) March 23 C) March 30 D) March 31	25.



26. Using $A, B, C, D,$ and E as the ingredients, the possible combinations are $ABC, ABD, ABE, ACD, ACE, ADE, BCD, BCE, BDE,$ and CDE . A) 6 B) 8 C) 10 D) 60		26. C
27. The sum of six consecutive integers must be odd. A) 81 B) 88 C) 92 D) 98		27. A
28. 1 day = 1440 min.; $288 \text{ min.} = (288/1440) = 20\%$. A) 10 B) 15 C) 20 D) 40		28. C
29. Two cousins visited Jane today. One cousin visits every 42 days. The other visits every 429 days. Since the l.c.m of 42 and 429 is 6006, they will next visit on the same day in 6006 days. A) 4296 B) 6006 C) 9009 D) 18018		29. B
30. $3^{2013} - 3^{2012} = 3^{2012} \times (3 - 1) = 2 \times 3^{2012}$. A) 3^1 B) 3^{2011} C) 2×3^{2012} D) 6^{1006}		30. C
31. At 3 P.M. the hands form a 90° angle; 14 mins. earlier the min. hand was $14/60 \times 360^\circ = 84^\circ$ back and the hr. hand was 7° back, so it's 167° . A) 84° B) 137° C) 167° D) 174°	31. C	
32. The median of 6 numbers is the average of the middle ones: $(\frac{3}{4} + \frac{4}{3}) \div 2$. A) 1 B) $\frac{669}{360}$ C) $\frac{7}{12}$ D) $\frac{25}{24}$	32. D	
33. This is a weighted average. Since the Master mix's sunflower percent is 10% less than the Blue mix's and 15% more than the Rye mix's, the ratio of Blue mix to Rye mix is 15:10. (The ratio is the reverse of the percents.) Thus, 15/25 of the Master mix is Blue mix. In 1000 g the part that is Blue mix is $15/25 \times 1000 = 600 \text{ g}$. A) 350 g B) 400 g C) 600 g D) 650 g		33. C
34. There are 50 multiples of 2 on the list, 25 multiples of 4, 12 of 8, 6 of 16, 3 of 32, and 1 of 64. That's 2^{97} or 2×4^{48} . A) 4^{25} B) 4^{32} C) 4^{48} D) 4^{50}		34. C
35. The ratio of the fraction of new books that are biographies to the fraction of used books that are biographies is $(0.7/0.85) : (0.3/0.15)$. This is equivalent to $(7/85) : (3/15) = (7/85) : (17/85)$. This simplifies to 7:17. A) 7:17 B) 14:17 C) 17:14 D) 17:7		35. A

The end of the contest  7

Information & Solutions

2012-2013 Annual 7th Grade Contest

Tuesday, February 26 (alternate date: February 19), 2013

Directions for Grading

- Security and Solutions** Do not look at these solutions until after the contest. Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- Urgent Questions?** For appeals or answers to urgent questions, write to comments@mathleague.com or call 1-201-568-6328.
- Scores** Please remember that *this is a contest, and not a test*—there is no “passing” or “failing” score. Few students score as high as 28 points (80% correct). Students with half that, 14 points, should be commended.
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- Return of Student Papers** *Originals* of contest papers with scores of 30 or more *must* be held until June 1. *Copies* of these papers, and originals of all other papers, should be returned to students after grading. Students scoring 30 points or more must confirm an *understanding* of the contest rules by signing the *Selected Math League Rules* (on the colored sheet of information and rules that accompanied the contests). Keep this signed sheet with the original contests until June 1. Please do not mail these to the League unless we ask you to do so.


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Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Adam Raichel, contest authors

2012-2013 7TH GRADE CONTEST SOLUTIONS

Answers

1. The difference between 10.98 and 11.00 = 0.02, so 11.00 is closest. A) 10.00 B) 10.90 C) 10.95 D) 11.00	1. D
2. $\sqrt{4 \times 9 \times 16} = 2 \times 3 \times 4 = 24$. A) 9 B) 24 C) 29 D) 36	2. B
3. The only choice that leaves a remainder of 4 when divided into 256 is 6. Thus, Mr. Barry could have 6 cubs. A) 5 B) 6 C) 8 D) 11	3. B
4. The tenths digit of 543.21 is 2, and its hundredths digit is 1. A) 543.21 B) 231.23 C) 654.56 D) 642.46	4. A
5. $3^2 + 3^2 + 3^2 = 9 + 9 + 9 = 27 = 3^3$. A) 3^3 B) 3^6 C) 9^3 D) 9^6	5. A
6. $3 \div \frac{1}{6} = (3 \times 3) \div (3 \times \frac{1}{6}) = 9 \div \frac{3}{6} = 9 \div \frac{1}{2}$. A) $\frac{1}{18}$ B) $\frac{1}{12}$ C) $\frac{1}{2}$ D) $\frac{9}{2}$	6. C
7. Since $2013 = 3 \times 11 \times 61$ and $418 = 2 \times 11 \times 19$, the correct answer is 418. A) 231 B) 365 C) 418 D) 542	7. C
8. If 3 times a number is 36, the number is 12; one-third of 12 is 4. A) 4 B) 12 C) 36 D) 108	8. A
9. If a case of eggs contains $12 \times 12 = 144$ eggs, then two crates of 12 cases contain $2 \times 12 \times 144 = 3456$ eggs. A) 48 B) 144 C) 288 D) 3456	9. D
10. $100000000 \div 10000 = 10000$. A) 10 B) 100 C) 1000 D) 10000	10. D
11.  As shown in the diagram, a diameter of the circular brim is equal to the length of a side of the square. The square has a side-length of 1 m. Since a radius of a circle is half of a diameter, the radius of the brim is 0.5 m. A) 0.5 m B) 1 m C) 2 m D) 4 m	11. A
12. $\frac{1}{3} \times \frac{2}{4} \times \frac{3}{5} \times \frac{4}{6} \times \frac{5}{7} \times \frac{6}{8} \times \frac{7}{9} \times \frac{8}{10} = \frac{1}{10} \times \frac{2}{9}$. A) $\frac{3}{19}$ B) $\frac{2}{9}$ C) $\frac{1}{9}$ D) $\frac{2}{90}$	12. B
13. $20 + 30 + 40 - (20 + 30 + 40) \div 3 = 90 - 30 = 60$. A) 0 B) 45 C) 60 D) 90	13. C



2012-2013 7TH GRADE CONTEST SOLUTIONS

Answers

14. If 130 of Del's last meals were sandwiches, then 120 were not. Since $120 \div 250 = 0.48$, 48% of those last 250 meals were not sandwiches. A) 40% B) 44% C) 48% D) 52%	14. C
15. The two least odd divisors of 120 are 1 and 3. A) 4 B) 5 C) 8 D) 15	15. A
16. Every 4×30 min. = 2 hours, I collect $4 \times 20 = 80$ seashells and drop 3 seashells. In 2 hours I have a total of 77 seashells, so in 8 hours I have $77 \times 4 = 308$ seashells. A) 68 B) 136 C) 296 D) 308	16. D
17. The number of nickels in \$3.00 is $300 \div 5 = 60$. The number of dimes in \$6.00 is $600 \div 10 = 60$. That's 120 coins; 240 quarters = \$60.00. A) \$12.00 B) \$15.00 C) \$30.00 D) \$60.00	17. D
18. 0.05% of 10000 = $0.0005 \times 10000 = 5$. A) 5 B) 50 C) 500 D) 5000	18. A
19. The middle number is $13 \div 13$. The integers are -5, -4, -3 . . . , 5, 6, and 7. A) 6 B) 7 C) 9 D) 13	19. B
20. One apple plus one orange costs \$1.50. If I spend $5 \times \$1.50 = \7.50 , I'll have \$1.30 left to buy 2 more apples. That's a total of 12 pieces. A) 11 B) 12 C) 13 D) 14	20. B
21. Since $10 = 2 + 3 + 5$, $12 = 2 + 3 + 7$, and $15 = 3 + 5 + 7$, Dragon Doug cannot read 13 books in 3 months. A) 10 B) 12 C) 13 D) 15	21. C
22. The average of 45674567 and 67896789 is $(45674567 + 67896789) \div 2 = 56785678$. A) 55443322 B) 55556666 C) 56565656 D) 56785678	22. D
23. $\sqrt{49} - \sqrt{16} = 7 - 4 = 3 = \sqrt{9}$. A) $\sqrt{33}$ B) $\sqrt{25}$ C) $\sqrt{9}$ D) $\sqrt{3}$	23. C
24. $2016^{2013} = (2^5 \times 3^2 \times 7)^{2013} = 2^{10065} \times 3^{4026} \times 7^{2013}$. A) 3^{2013} B) 3^{2015} C) 3^{4026} D) 3^{6039}	24. C
25. Friday, Mar. 4, is the 3rd day it's open. Three weeks later, Mar. 25, is the 18th day. Monday, Mar. 28, is day 19, so Mar. 30 is the 21st day. A) March 22 B) March 23 C) March 30 D) March 31	25. C



26. A rectangular prism is 5 m long, 4 m wide, and 6 m high. What is the sum of the lengths of its edges?

- A) 15 m B) 60 m C) 80 m D) 120 m

27. What is the ratio of $1\frac{1}{3}$ to its reciprocal?

- A) 1 B) $\frac{3}{4}$ C) $\frac{4}{3}$ D) $\frac{16}{9}$

28. Pens come in packs of 3, 6, 8, and 12. I bought 12 packs and got a total of 121 pens. If I bought at least one of each size pack, how many packs of 8 pens did I buy?

- A) 1 B) 2 C) 3 D) 4

29. $3^2 \times 8^2 \times 5^2 = 6^2 \times \underline{\quad} \times 10^2$

- A) $\frac{1}{2}$ B) 2 C) 2^2 D) 2^3

30. I wrote the first 100 positive integers in order, and then erased every "1" I had written. How many digits did I erase?

- A) 18 B) 19 C) 20 D) 21

31. What is the difference between the product and the sum of the non-zero digits of 20^{10} when it is written in decimal form?

- A) 1 B) 2 C) 10^2 D) 2×10

32. In the sequence $20, \frac{19}{2}, \frac{18}{3}, \frac{17}{4}, \dots$, each term after the first term is gotten by subtracting 1 from the previous term's numerator and adding 1 to the previous term's denominator. How many terms in this sequence are positive integers?

- A) 1 B) 2 C) 3 D) 4

33. Two congruent rectangular cards partially overlap. The area of overlap is a square with area 4, and the total area of the regions of the faces of the two cards that *do not overlap* is 12. What is the area of one card?

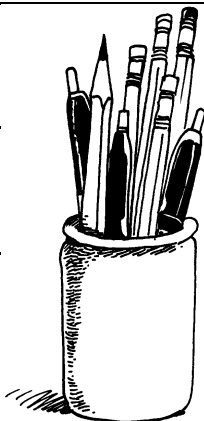
- A) 4 B) 6 C) 8 D) 10


34. If the mean of three positive integers is 5, then the product of all 3 integers is *at most*

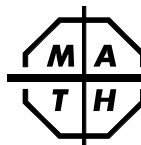
- A) 105 B) 120 C) 125 D) 150

35. What is the sum of the digits of the least 3-digit integer whose square is a 6-digit integer?

- A) 5 B) 7 C) 9 D) 11



The end of the contest  7



Sample 7th Grade Contest

Tuesday, February 19 (alternate date: February 26), 2019

7

Instructions

- **Time** Do *not* open this booklet until told by your teacher to begin. You might be *unable* to finish all 35 questions in the 30 minutes allowed.
- **Scores** Remember that *this is a contest, not a test*—there is no “passing” or “failing” score. Few students score 28 points (80% correct). Students with half that, 14 points, *should be commended!* High-scoring students may be invited to our “Math Camp” in July.
- **Results Posted Online** High-scoring contest results, both overall and regional, will be posted at www.mathleague.com no later than April 15.
- **Format, Point Value, & Eligibility** Every answer is an A, B, C, or D. Write answers in the *Answers* column. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you are in grade 7 or below and only if you don’t also take this year’s Annual 6th or Annual 8th Grade Contest.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Time at Start of Contest _____ Today’s Date _____

Do Not Write In The Space Below

To the Teacher:

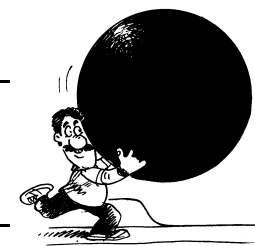
Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.* Student’s Score: _____

Twenty-one books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6, 7), Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6, 7), and High School (Vols. 1, 2, 3, 4, 5, 6, 7)* are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

1. $(2 \times 4 \times 8) \div 2 = 4 \times \underline{\quad}$ A) 2 B) 4 C) 8 D) 16	1.
2. Al sleeps daily for 3 times as many hours as he is awake. For how many hours does Al sleep daily? A) 6 B) 9 C) 12 D) 18	2.
3. The number 36 is the product of -6 and A) -6 B) 6 C) -30 D) 42	3.
4. $20 \times 18 = 20 \times 19 + 20 \times \underline{\quad}$ A) -1 B) 0 C) 1 D) 20	4.
5. Angel arrived $\frac{3}{10}$ of an hour early for her noon appointment. At what time did Angel arrive? A) 11:18 a.m. B) 11:20 a.m. C) 11:40 a.m. D) 11:42 a.m.	5.
6. The product of the least and greatest positive odd factors of 2019 is A) 673 B) 2019 C) 2020 D) 6057	6.
7. The average value of the ten whole numbers from 0 through 9 is A) 5.5 B) 5 C) 4.5 D) 4	7.
8. $2019 \times 3 + 2019 \div 3 = 2019 \times (3 + \underline{\quad})$ A) 0 B) $\frac{1}{3}$ C) 1 D) 3	8.
9. The product of four 4s equals the sum of $\underline{\quad}$ 4s. A) 4 B) 3×4 C) 4^3 D) 4^4	9.
10. What is the area of a square if one-third its side-length is 4? A) 12 B) 16 C) 48 D) 144	10.
11. On a Monday my surf club had 20 members. If the number of members doubled each day, on what day did my club first have over 2018 members? A) Sunday B) Monday C) Tuesday D) Friday	11.
12. Rounding a decimal to the nearest whole number yields a number that is at most $\underline{\quad}$ greater than the original decimal. A) 0.05 B) 0.1 C) 0.5 D) 0.9	12.
13. The perimeter of a rectangle with area 2019 and integral side-lengths is greatest when its length and width differ by A) 0 B) 1 C) 670 D) 2018	13.



14. If half of my pals have at least 1 pet, and $\frac{1}{3}$ of my pals with a pet have more than 1 pet, what fraction of my pals have exactly 1 pet? A) $\frac{1}{6}$ B) $\frac{1}{3}$ C) $\frac{2}{3}$ D) $\frac{5}{6}$	14.
15. The average of 0.5, 1.5, and 2.5 equals the average of 1 and A) 1 B) 1.5 C) 2 D) 2.5	15.
16. $9 \times 90 \times 900 \times 9000 = 9 \times \underline{\quad}$ A) 100^3 B) 900^3 C) 9000^3 D) 9000000^3	16.
17. What is one less than the product -18×19 ? A) -341 B) -342 C) -343 D) -344	17.
18. When I divide the number of digits in the decimal form of 10^{2018} by 4, the remainder is A) 3 B) 2 C) 1 D) 0	18.
19. My first name has 60% as many letters as my last name. My first name <i>could</i> be A) Al B) Ali C) Alex D) Alexa	19.
20. What is the <i>least</i> possible sum of two integers whose product is 12? A) -13 B) -11 C) 7 D) 8	20.
21. Of the first 100 positive integers, $\underline{\quad}$ are <i>not</i> multiples of both 2 and 3. A) 16 B) 32 C) 64 D) 84	21.
22. If one-third of the eggs in each carton of 1-dozen eggs are cracked, I must buy $\underline{\quad}$ cartons to get 16-dozen eggs that are <i>not</i> cracked. A) 48 B) 36 C) 24 D) 20	22.
23. Which of the following is nearest in value to 8.25? A) $8\frac{2}{5}$ B) $8\frac{2}{10}$ C) $8\frac{5}{10}$ D) $8\frac{10}{25}$	23.
24. I bowled on 2 days every week, on a different pair of days each week that I bowled. For at most how many weeks did I bowl? A) 14 B) 21 C) 28 D) 35	24.
25. Which of the following has the least value? A) 0.1 B) 0.01 C) 0.0011 D) $(0.01)^2$	25.



26. Such a prism has 4 edges of each size. The sum of the 3 dimensions is 15 m, so the sum of all the lengths is 60 m.

- A) 15 m B) 60 m C) 80 m D) 120 m

27. The ratio of $\frac{4}{3}$ to $\frac{3}{4}$ is $\frac{16}{9}$.

- A) 1 B) $\frac{3}{4}$ C) $\frac{4}{3}$ D) $\frac{16}{9}$

28. I bought an odd number of pens, so I bought an odd number of packs of 3. If I bought 1 pack of 3, I could have bought 2 packs of 8, 1 pack of 6, and 8 packs of 12. No other number of packs of 3 yields 12 packs.

- A) 1 B) 2 C) 3 D) 4

29. $3^2 \times (2 \times 2 \times 2)^2 \times 5^2 = (3 \times 2)^2 \times 2^2 \times (5 \times 2)^2$.

- A) $\frac{1}{2}$ B) 2 C) 2^2 D) 2^3

30. There is one "1" from 1 to 9, 11 "1"s from 10 to 19, one "1" in each of the next 8 groups of 10 integers, and one "1" in 100.

- A) 18 B) 19 C) 20 D) 21

31. When expanded, $20^{10} = 1024000000000$. The difference between the product and the sum of the non-zero digits is $8 - 7 = 1$.

- A) 1 B) 2 C) 10^2 D) 2×10

32. In the sequence $20, \frac{19}{2}, \frac{18}{3}, \frac{17}{4}, \dots$, each term after the first term is gotten by subtracting 1 from the previous term's numerator and adding 1 to the previous term's denominator. The only integers in this sequence are 20, $18/3$, and $14/7$.

- A) 1 B) 2 C) 3 D) 4

33. The area of each rectangle is half of the area of the non-overlapping region plus the area of the square. Therefore, the area of each rectangle is $12/2 + 4 = 10$.

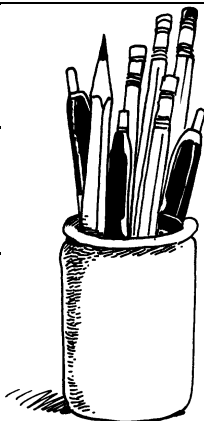
- A) 4 B) 6 C) 8 D) 10

34. If the mean of three positive integers is 5, their sum is 15. The integers could be 5, 5, and 5.

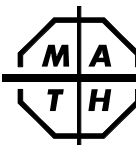
- A) 105 B) 120 C) 125 D) 150

35. Since the square root of 100 000 is between 316 and 317, 317 is the smallest such 3-digit integer.

- A) 5 B) 7 C) 9 D) 11



The end of the contest 7



Information & Solutions

7

Tuesday, February 19 (alternate date: February 26), 2019

Directions for Grading

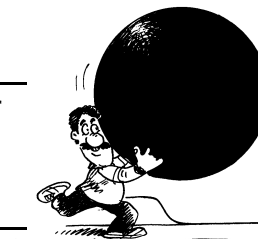
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1. $(2 \times 4 \times 8) \div 2 = 1 \times 4 \times 8 = 4 \times 8$. A) 2 B) 4 C) 8 D) 16	1. C
2. Al sleeps daily for $\frac{3}{4}$ of the day. Therefore, Al sleeps for 18 hours. A) 6 B) 9 C) 12 D) 18	2. D
3. $36 = 6 \times 6 = (-6) \times (-6)$. A) -6 B) 6 C) -30 D) 42	3. A
4. $20 \times (19 - 1) = 20 \times 19 + 20 \times (-1)$. A) -1 B) 0 C) 1 D) 20	4. A
5. Since $\frac{3}{10}$ of 60 minutes is 18 minutes, Angel arrived 18 minutes before 12 p.m.; that's 11:42 a.m. A) 11:18 a.m. B) 11:20 a.m. C) 11:40 a.m. D) 11:42 a.m.	5. D
6. The product of 1 and 2019 is 2019. A) 673 B) 2019 C) 2020 D) 6057	6. B
7. The sum of the first ten whole numbers is 45. Their average is 4.5. A) 5.5 B) 5 C) 4.5 D) 4	7. C
8. $2019 \times 3 + 2019 \times \frac{1}{3} = 2019 \times (3 + \frac{1}{3})$. A) 0 B) $\frac{1}{3}$ C) 1 D) 3	8. B
9. The product of four 4s = $256 = 4 \times 64$; this is the sum of 64 4s. A) 4 B) 3×4 C) 4^3 D) 4^4	9. C
10. If $\frac{1}{3}$ the side-length is 4, the side-length is 12 and the area is 144. A) 12 B) 16 C) 48 D) 144	10. D
11. Doubling 20 six times, my surf club had 2560 members 7 days later. Seven days after a Monday is also a Monday. A) Sunday B) Monday C) Tuesday D) Friday	11. B
12. A number such as 4.5 is rounded to 5, an increase of 0.5. This is the greatest possible increase when a number is rounded to the nearest integer. A) 0.05 B) 0.1 C) 0.5 D) 0.9	12. C
13. The perimeter is greatest when the length is 2019 and the width is 1. The difference between dimensions is at most 2018. A) 0 B) 1 C) 670 D) 2018	13. D



14. Using 6 pals, 3 pals have at least 1 pet, and $\frac{1}{3}$ of them, or 1 pal, has more than 1 pet. The fraction of my pals with exactly 1 pet is $\frac{2}{6}$. A) $\frac{1}{6}$ B) $\frac{1}{3}$ C) $\frac{2}{3}$ D) $\frac{5}{6}$	14. B
15. The average of 0.5, 1.5, and 2.5 is 1.5; the average of 1 and 2 is also 1.5. A) 1 B) 1.5 C) 2 D) 2.5	15. C
16. $9 \times (9 \times 10) \times (9 \times 100) \times (9 \times 1000) = 9 \times (9^3 \times 1000000) = 9 \times 900^3$. A) 100^3 B) 900^3 C) 9000^3 D) 9000000^3	16. B
17. The number one less than -342 is -343. A) -341 B) -342 C) -343 D) -344	17. C
18. The number of digits in the decimal form of 10^{2018} is 2019; $2019 \div 4$ is 504R3. A) 3 B) 2 C) 1 D) 0	18. A
19. The number of letters in the first name "Ali" is 60% of the number of letters in a 5-letter last name. A) Al B) Ali C) Alex D) Alexa	19. B
20. $12 = \pm 1 \times \pm 12 = \pm 2 \times \pm 6 = \pm 3 \times \pm 4$; the least sum is $-1 + (-12) = -13$. A) -13 B) -11 C) 7 D) 8	20. A
21. Since $100 \div 6 = 16R4$, 16 are multiples of both 2 and 3, and 84 are not. A) 16 B) 32 C) 64 D) 84	21. D
22. Since each carton contains 8 eggs that are not cracked, 3 cartons contain 2 dozen eggs that are not cracked. I need 24 cartons in all. A) 48 B) 36 C) 24 D) 20	22. C
23. In order, the choices are 8.40, 8.20, 8.50 and 8.40: 8.20 is nearest. A) $8\frac{2}{5}$ B) $8\frac{2}{10}$ C) $8\frac{5}{10}$ D) $8\frac{10}{25}$	23. B
24. Each day can be paired with 6 other days for a total of 42 pairs. However, each pair has been counted twice, so there are 21 pairs. A) 14 B) 21 C) 28 D) 35	24. B
25. Write with 4 digits to the right of the decimal. A) 0.1 B) 0.01 C) 0.0011 D) $(0.01)^2$	25. D



29. $2^{10} \times 2^{10} =$ A) 2^{20} B) 2^{100} C) 4^{20} D) 4^{100}
30. I got immunized on the one millionth second of this calendar year. That happened on
A) January 11 B) January 12
C) February 1 D) February 2
31. $\sqrt{16^{16}} =$
A) 4^4 B) 4^8 C) 16^4 D) 16^8
32. Each of 2005 fractions has an even numerator and an odd denominator. If the product of all of them is an integer, it must be
A) even B) odd C) prime D) 2005
33. If x is a whole number, what is the largest possible perimeter of a triangle with side-lengths 3, 4, and x ?
A) 11 B) 12 C) 13 D) 14
34. When fully expanded, $10\,000^{9999}$ has ? digits.
A) 9999 B) 10 000 C) 39 996 D) 39 997
35. In the diagram, the total number of different triangles is
A) 2 B) 3 C) 4 D) 5
36. If the sum of 2000 consecutive integers is 1000, then the sum of the digits of the *greatest* of these 2000 integers is
A) 1 B) 2 C) 9 D) 27
37. How many of the 15 positive factors of 400 are divisible by 4?
A) 4 B) 8 C) 9 D) 10
38. I phoned my mom to help me answer this, the final question on a quiz show: *How many integers equal their own squares?* Mom said, "?." She was right!
A) zero B) one
C) two D) three
39. At 12:22, a clock's hour hand is ? away from a vertical position.
A) 10° B) 11° C) 21° D) 22°
40. What is the tens' digit of the product $1 \times 2 \times 3 \times \dots \times 98 \times 99$?
A) 4 B) 6 C) 8 D) 0



The end of the contest 8

Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors



Sample 8th Grade Contest

Tuesday, February 22 (alternate date: February 15), 2005

8

Instructions

- Time** Do *not* open this booklet until you are told by your teacher to begin. You will have only *30 minutes* working time for this contest. You might be *unable* to finish all 40 questions in the time allowed.
- Scores** Please remember that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 30 points (75% correct). Students with half that, 15 points, *should be commended!*
- Format, Point Value, & Eligibility** This is a multiple-choice contest. Every answer is an A, B, C, or D. You must write each answer in the *Answers* column to the right of each question. We suggest (but do not require) that you use a pencil. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you’re in grade 8 or below and only if you don’t also take this year’s *Annual 7th Grade* or *Annual 6th Grade Contest*.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Time at Start of Contest _____ Today’s Date _____

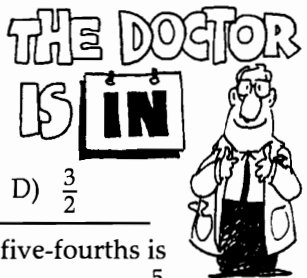
Do Not Write In The Space Below

To the Teacher:

Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.* **Student’s Score:** _____

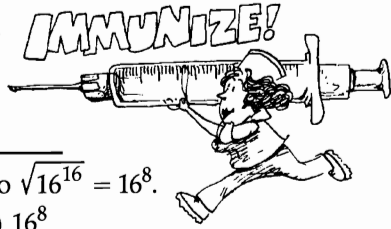


Fifteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5)*, and *High School (Vols. 1, 2, 3, 4, 5)*, are available, for \$12.95 per volume (\$15.95 Canadian), from Math League Press, P.O. Box 17, Tenafly, N.J. 07670-0017.


1. $1110 - 1020 = 110 - ?$ A) 102 B) 101 C) 90 D) 20
2. If my doctor's "IN" sign is a square with a perimeter of 4, then its area is
A) 1 B) 4 C) 8 D) 16
3. $300 \div 200 = 1 \div ?$
A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{3}{2}$
4. When written as an improper fraction, five-fourths is
A) $\frac{4}{5}$ B) $1\frac{1}{4}$ C) 1.25 D) $\frac{5}{4}$
5. $2005 - 2005 - 2004 =$ A) 1 B) -2004 C) -2005 D) -2006
6. Exactly 120 seconds after midnight, the correct time is
A) 12:02 P.M. B) 12:02 A.M. C) 2 P.M. D) 2 A.M.
7. $24 \div 4 \times 2 + 4 =$
A) 1 B) 7 C) 16 D) 36
8. The reciprocal of $(\frac{1}{2} \times 4)$ is
A) $2 \times \frac{1}{4}$ B) $\frac{1}{2} \times 4$ C) $\frac{1}{2} \times \frac{1}{4}$ D) 2×4
9. Of the following numbers, which is closest in value to 1?
A) 0.995 B) 0.99 C) 1.01 D) 1.1
10. What is the sum of all the one-digit positive prime numbers?
A) 15 B) 16 C) 17 D) 18
11. $2 \times \frac{1}{2} \times 4 \times \frac{1}{4} \times 6 \times \frac{1}{6} =$
A) 1 B) 6 C) 12 D) 24
12. When I add the measures of any 2 angles of triangle T, the sum is always 120° . Triangle T must be
A) scalene B) right C) obtuse D) equiangular
13. I wear my headphones only on cloudy days. The day after each cloudy day is a sunny day. I wear my headphones at most ? times in a week.
A) 3 B) 4 C) 5 D) 6
14. Of the following, which has the largest value?
A) 7 B) $(-1)^2$ C) $(-2)^2$ D) $(-3)^2$
15. $9000\% + 900\% + 90\% + 9\% =$
A) 9999 B) 999.9 C) 99.99 D) 0.9999



16. A dealer paid Bunny Fabergé 50 pennies for each of his decorated eggs. The dealer then sold each egg for 50 quarters. Bunny (the artist) got what percent of the final purchase price?
A) 2% B) 4% C) 25% D) 50%
17. $\sqrt{\sqrt{256}} =$
A) 2 B) 4 C) 8 D) 16
18. $30\% \times 40\% =$ A) 12% B) 120% C) 1200% D) 12000%
19. The number ? has exactly 4 different whole number factors.
A) 30 B) 24 C) 12 D) 10
20. When rounded to the nearest fifth, 0.33 becomes
A) 0.2 B) 0.3 C) $\frac{2}{5}$ D) $\frac{3}{5}$
21. I lost my coins! This morning, I had 7 coins worth 49¢. How many nickels did I have?
A) 0 B) 1 C) 2 D) 7
22. $1.5 \text{ m} + 60 \text{ cm} + 0.02 \text{ km} =$
A) 0.221 m B) 2.21 m C) 22.1 m D) 221 m
23. How many of the positive multiples of 2 are factors of 222?
A) 111 B) 4 C) 3 D) 1
24. What is the average of the first 99 positive whole numbers?
A) 49.00 B) 49.50 C) 49.75 D) 50.00
25. If a small circle's diameter is a large circle's radius, then the small circle's area is ?% of the large circle's area.
A) 20 B) 25 C) 40 D) 50
26. If $\frac{2}{3}$ of a cup of fish food can feed 8 goldfish, then 4 cups of fish food should be able to feed ? goldfish.
A) 12 B) 24 C) 36 D) 48
27. An integer cannot be ? if its square is even.
A) prime B) odd C) even D) zero
28. If $4x =$ the reciprocal of $\frac{1}{x^3}$, then x could equal
A) $\frac{1}{8}$ B) $\frac{1}{2}$ C) 2 D) 8



29. $2^{10} \times 2^{10} = 2^{10+10} = 2^{20}$. A) 2^{20} B) 2^{100} C) 4^{20} D) 4^{100}	29. A
30. Divide by 60 to get # minutes. Repeat to get # hours. Divide result by 24 to get # days ≈ 11.57 . A) January 11 B) January 12 C) February 1 D) February 2 	30. B
31. As in 29 above, $16^8 \times 16^8 = 16^{16}$, so $\sqrt{16^{16}} = 16^8$. A) 4^4 B) 4^8 C) 16^4 D) 16^8	31. D
32. If 2005 fractions each have an even numerator and an odd denominator of 1, their product would be an even integer. A) even B) odd C) prime D) 2005	32. A
33. In a \triangle , the sum of the 2 smaller side-lengths must be greater than the 3rd side-length. Thus, the perimeter $\leq 3+4+6 = 13$. A) 11 B) 12 C) 13 D) 14	33. C
34. $10\,000^{9999} = (10^4)^{9999} = 10^{39\,996}$. That's 1 followed by 39 996 zeroes! A) 9999 B) 10 000 C) 39 996 D) 39 997	34. D
35. The 2 small and 2 large \triangle s are shown: A) 2 B) 3 C) 4 D) 5 	35. C
36. The 2000 integers $-999, -998, \dots, 998, 999, 1000$ have a sum of 1000. The digit-sum of the largest integer used is $1+0+0+0 = 1$. A) 1 B) 2 C) 9 D) 27	36. A
37. The 9 factors divisible by 4 are 4, 8, 16, 20, 40, 80, 100, 200, & 400. A) 4 B) 8 C) 9 D) 10	37. C
38. Notice that $0^2 = 0$ and that $1^2 = 1$. These are the only two integers which are equal to their own squares. A) zero B) one C) two D) three 	38. C
39. The hr. hand moves 30° in 1 hr. and $(22/60) \times 30^\circ = 11^\circ$ in 22 mins. A) 10° B) 11° C) 21° D) 22°	39. B
40. The product includes several multiples of 10; it's divisible by 100. A) 4 B) 6 C) 8 D) 0	40. D

The end of the contest  8

Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors

Information & Solutions

2004-2005 Annual 8th Grade Contest

Tuesday, February 22 (alternate date: February 15), 2005

Directions for Grading

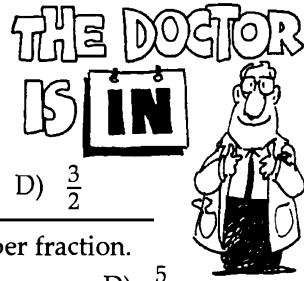
8

- Security and Solutions** Do not look at these solutions until after the contest. Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- Urgent questions?** Call 1-201-568-6328.
- Scores** Please remember that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 30 points (75% correct). Students with half that, 15 points, *should be commended!*
- Awards & Results** The original contest package contained 5 *Certificates of Merit*—1 each for the highest scoring student on each grade level, plus extras for ties. Do you need more *Certificates of Merit*? If so, include your name, school, and school mailing address in a letter to: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**, and include a self-addressed, stamped envelope (2 stamps required) large enough to hold certificates. Only score reports postmarked by Fri., Feb. 25, 2005, and received by Tues., Mar. 9, 2005 can be used in our *Summary of Contest Results* newsletter, which you'll receive no later than Tues., May 10, 2005.
- Return of Student Papers** *Originals* of contest papers with scores of 30 or more *must* be held until June 1. *Copies* of these papers, and originals of all other papers, should be returned to students after grading. Students scoring 30 points or more must confirm an *understanding* of the contest rules by signing the *Selected Math League Rules* (on the colored sheet of information and rules that accompanied the contests). Keep this signed sheet with the original contests until June 1. Please do not mail these to the League unless we ask you to do so.

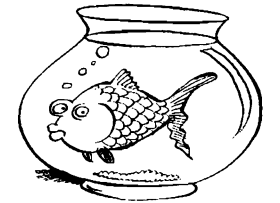
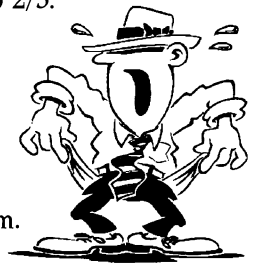
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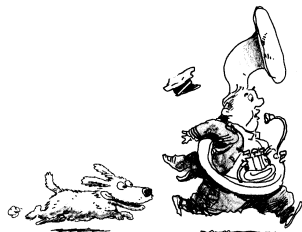
1. Subtract 1000 from each: $110 - 020$. A) 102 B) 101 C) 90 D) 20
2. Each side of the square has length $4 \div 4 = 1$. The square's area = $1^2 = 1$.
A) 1 B) 4 C) 8 D) 16
3. $300 \div 200 = 3/2 = 1 \times (3/2) = 1 \div (2/3)$.
A) $\frac{1}{3}$ B) $\frac{1}{2}$ C) $\frac{2}{3}$ D) $\frac{3}{2}$
4. Five-fourths = $5/4$, which is an improper fraction.
A) $\frac{4}{5}$ B) $1\frac{1}{4}$ C) 1.25 D) $\frac{5}{4}$
5. $(2005 - 2005) - 2004 = -2004$. A) 1 B) -2004 C) -2005 D) -2006
6. 120 seconds = 2 minutes, so the time is 12:02 A.M.
A) 12:02 P.M. B) 12:02 A.M. C) 2 P.M. D) 2 A.M.
7. $24 \div 4 \times 2 + 4 = [(24 \div 4) \times 2] + 4 = (6 \times 2) + 4 = 12 + 4 = 16$.
A) 1 B) 7 C) 16 D) 36
8. $\frac{1}{2} \times 4 = 2$, so its reciprocal is $\frac{1}{2} = 2 \times \frac{1}{4}$.
A) $2 \times \frac{1}{4}$ B) $\frac{1}{2} \times 4$ C) $\frac{1}{2} \times \frac{1}{4}$ D) 2×4
9. $1.000 - 0.995 = 0.005$; $1.000 - 0.990 = 0.010$;
 $1.010 - 1.000 = 0.010$; $1.100 - 1.000 = 0.100$.
A) 0.995 B) 0.99 C) 1.01 D) 1.1
10. By definition, 1 is *not* a prime, so the sum is $2 + 3 + 5 + 7 = 17$.
A) 15 B) 16 C) 17 D) 18
11. $2 \times \frac{1}{2} \times 4 \times \frac{1}{4} \times 6 \times \frac{1}{6} = (2 \times \frac{1}{2}) \times (4 \times \frac{1}{4}) \times (6 \times \frac{1}{6}) = 1 \times 1 \times 1 = 1$.
A) 1 B) 6 C) 12 D) 24
12. The sum of the measures of each possible pair of angles is 120° , so each angle is 60° . Therefore, triangle *T* must be equilateral.
A) scalene B) right C) obtuse D) equilateral
13. If Sunday is cloudy, then Tuesday, Thursday, and Saturday may also be cloudy. I wear my headphones at most 4 times in a week.
A) 3 B) 4 C) 5 D) 6
14. Of the choices below, D has the largest value.
A) 7 B) $(-1)^2 = 1$ C) $(-2)^2 = 4$ D) $(-3)^2 = 9$
15. $9000\% + 900\% + 90\% + 9\% = 90 + 9 + 0.9 + 0.09 = 99.99$.
A) 9999 B) 999.9 C) 99.99 D) 0.9999



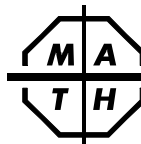
16. A dealer paid Bunny Fabergé 50¢ for each of his eggs. The dealer then sold each egg for 50 quarters. For each penny Fabergé got, the dealer got 25¢, so Fabergé got 4¢ on the dollar, which is 4%.
A) 2% B) 4% C) 25% D) 50%
17. Since $\sqrt{256} = 16$, $\sqrt{\sqrt{256}} = \sqrt{16} = \sqrt{4} = 2$.
A) 2 B) 4 C) 8 D) 16
18. $0.3 \times 0.4 = 0.12$. A) 12% B) 120% C) 1200% D) 12000%
19. The 4 whole numbers factors of 10 are 1, 2, 5, and 10.
A) 30 B) 24 C) 12 D) 10
20. $1/5 = 0.2 < 0.33 < 0.4 = 2/5$; 0.33 closer to $2/5$.
A) 0.2 B) 0.3 C) $\frac{2}{5}$ D) $\frac{3}{5}$
21. I had 4 pennies; need 3 coins = 45¢, so I need 1 quarter; 2 coins = 20¢ are 2 dimes.
A) 0 B) 1 C) 2 D) 7
22. $1.5 \text{ m} + 60 \times 0.01 \text{ m} + 0.02 \times 1000 \text{ m} = 22.1 \text{ m}$.
A) 0.221 m B) 2.21 m C) 22.1 m D) 221 m
23. There are four even factors of 222. They are 2, 6, 74, and 222.
A) 111 B) 4 C) 3 D) 1
24. The average of 1, 2, . . . , 98, 99 is the middle number, 50.
A) 49.00 B) 49.50 C) 49.75 D) 50.00
25. In the large circle, if $r = 2$, then the large circle's area would be 4π . Small circle then has $r = 1$, so $A = \pi$. That's 25% of 4π .
A) 20 B) 25 C) 40 D) 50
26. If $2/3$ cup of fish food feeds 8 goldfish, then $1/3$ cup feeds 4 fish, and 1 cup feeds 12 fish. Thus, 4 cups feed 48 fish.
A) 12 B) 24 C) 36 D) 48
27. The square of an odd number is always odd.
A) prime B) odd C) even D) zero
28. Since the reciprocal of $\frac{1}{x^3}$ is x^3 , $4x = x^3$. The value $x = 2$ works.
A) $\frac{1}{8}$ B) $\frac{1}{2}$ C) 2 D) 8



26. Sprinkles the dog likes to chase marching bands. When he does, he runs at 18 km per hour, which is the same as running at ? m per second.
A) 5 B) 6 C) 10 D) 18
27. If the sum of 2 integers is 25, the product of the integers could not be
A) -150 B) -30 C) 100 D) 154
28. How many of the first 1000 positive integers are multiples of both 4 and 5 but not of 6?
A) 34 B) 42 C) 50 D) 58
29. $\frac{3}{5} : 6 = 8 : \underline{?}$
A) $\frac{20}{9}$ B) $\frac{9}{5}$ C) 24 D) 80
30. If the average of three positive integers is 5, the greatest possible value of the sum of the squares of the three integers is
A) 107 B) 149 C) 171 D) 197
31. After a long walk yesterday, Cody wants to go 50% farther today in half as much time. What percent faster will she have to walk today than she did yesterday to meet her goal?
A) 200% B) 300% C) 400% D) 500%
32. What is the greatest prime factor of $9^{18} - 3^{32}$?
A) 5 B) 17 C) 19 D) 31
33. How many factors of $3 \times 6 \times 9 \times 12 \times 15 \times 18$ are greater than 1 and are the square of an integer?
A) 15 B) 14 C) 7 D) 6
34. Each time Bette fills out a form, she marks *just one* box: A, B, or C. If she checks boxes at random, the probability that in filling out 3 such forms she will mark one each of A, B, and C is
A) $\frac{1}{4}$ B) $\frac{1}{3}$ C) $\frac{2}{9}$ D) $\frac{3}{10}$
35. In the sequence 105, 107, 112, 114, . . . , every number besides 105 and 107 is 7 greater than an earlier number. Which of the following may appear in this sequence?
A) 1296 B) 1648 C) 2137 D) 2818



The end of the contest 8



Sample 8th Grade Contest

Tuesday, February 26 (alternate date: February 19), 2013

8

Instructions

- **Time** Do *not* open this booklet until told by your teacher to begin. You might be *unable* to finish all 35 questions in the 30 minutes allowed.
- **Scores** Remember that *this is a contest, not a test*—there is no “passing” or “failing” score. Few students score 28 points (80% correct). Students with 14 points, *should be commended!* High-scoring students may be invited to our “Math Camp,” held last August at Stanford University.
- **Results Posted Online** Scores of high-scoring schools, both regional and overall, will be posted at www.mathleague.com no later than April 15.
- **Format, Point Value, & Eligibility** Every answer is an A, B, C, or D. Write answers in the *Answers* column. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you are in grade 8 or below and only if you don’t also take this year’s Annual 6th or Annual 7th Grade Contest.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____
 School _____ Teacher _____ Grade Level _____
 Time at Start of Contest _____ Today’s Date _____

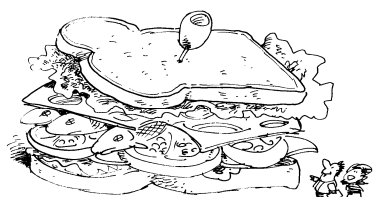
Do Not Write In The Space Below

To the Teacher:

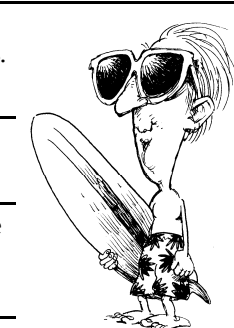
Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.* Student’s Score: _____

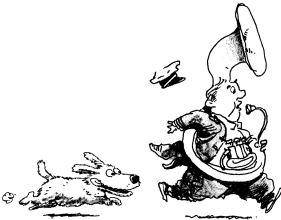

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1. $(1 + 4 + 1 + 4) \times \underline{\quad} = 14140$ A) 10 B) 1010 C) 1414 D) 10000	1.
2. The number of fish in a giant sandwich is divisible by 2, 3, 4, and 5. There could be <u>?</u> fish. A) 2345 B) 4567 C) 5550 D) 6660	2.
3. The average of 25 and <u>?</u> is 2013. A) 994 B) 1019 C) 1988 D) 4001	3.
4. Bob rides his bicycle at 40 km per hour. How far will Bob ride in 3 minutes? A) 1 km B) 2 km C) 3 km D) 4 km	4.
5. I am waiting in line with 10 people in front of me, including my brother. My brother has 10 people behind him in line, including me. If my brother is right in front of me, how many people are in line? A) 11 B) 19 C) 20 D) 21	5.
6. Each of my 60 books has either a hard cover or a soft cover. If I have 4 times as many hard covers as soft covers, I have <u>?</u> hard covers. A) 48 B) 35 C) 15 D) 12	6.
7. The largest odd factor of 111 is A) 3 B) 37 C) 109 D) 111	7.
8. My coin jar has 100 pennies, 200 nickels, 300 dimes, and 400 quarters in it. The coins have a total value of A) \$91 B) \$121 C) \$141 D) \$161	8.
9. The hundreds digit of the product $123456789 \times 234567890$ is A) 0 B) 1 C) 2 D) 3	9.
10. Ben finds a pair of eyes under 40% of the rocks he checks. If he looks under 400 rocks, he will find <u>?</u> eyes. A) 100 B) 160 C) 200 D) 320	10.
11. $12 \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{1}{6} =$ A) $\frac{1}{144}$ B) $\frac{1}{12}$ C) 1 D) 12	11.
12. If the measures of the angles of triangle T are in a 1:2:3 ratio, what kind of triangle is T ? A) acute B) obtuse C) right D) isosceles	12.




13. Of the following, which is greatest? A) $9 + 8 \times 6 - 4 \div 2$ B) $(9 + 8) \times 6 - 4 \div 2$ C) $9 + 8 \times (6 - 4) \div 2$ D) $(9 + 8) \times (6 - 4) \div 2$	13.
14. Coal miner Axel found diamonds! If the number of diamonds Axel found was the least common multiple of 18, 28, and 38, he found <u>?</u> diamonds. A) 2 B) 84 C) 4788 D) 19152	14.
15. 7 hundredths + 7 thousandths = 7 tenths - <u>?</u> A) 0.623 B) 0.777 C) 0.784 D) 0.854	15.
16. $2^2 \times 2^2 \times 2^2 + 2^2 \times 2^2 + 2^2 = 2^2 \times \underline{\quad}$ A) 16 B) 21 C) 32 D) 33	16.
17. If I multiply the number of math contests I have taken in my life by 6 and then add 5, the resulting number <i>cannot</i> be divisible by A) 5 B) 7 C) 9 D) 11	17.
18. An evil witch casts a spell to put a princess to sleep for 10000 hours. If the princess falls asleep at 6:00 P.M., she will wake at A) 10:00 A.M. B) 4:00 P.M. C) 8:00 P.M. D) 11:00 P.M.	18.
19. Of the rocks in a box, $\frac{1}{3}$ are igneous, 60 are metamorphic, and the remaining 40% are sedimentary. How many rocks are in the box? A) 160 B) 180 C) 200 D) 225	19.
20. The sum of 4 consecutive even integers is 148. The sum of the digits of the smallest of the 4 integers is A) 6 B) 7 C) 9 D) 12	20.
21. Max has 9 pairs of glasses for every 2 surfboards he has. If he has 108 pairs of glasses, he has <u>?</u> surfboards. A) 12 B) 24 C) 48 D) 486	21.
22. $180 + 150\%$ of 180 = A) 270 B) 330 C) 450 D) 630	22.
23. The perimeter of a triangle is 50. The length of the longest side of the triangle could be A) 15 B) 20 C) 25 D) 29	23.
24. If $x \square y$ is defined as $(x + y)^2 - 2xy$, then $5 \square 7 =$ A) 12 B) 24 C) 35 D) 74	24.
25. A square of side-length 4π has the same perimeter as a circle of diameter A) 2 B) 4 C) 8 D) 16	25.



26. Since 18 km per 60 minutes = 18/60 km per 1 minute = 0.3 km per 60 seconds, and 0.3 km = 300 m, he runs 300 m in 60 seconds, or 300/60 = 5 m in 1 second. A) 5 B) 6 C) 10 D) 18	
27. $-5 \times 30 = -150$, $5 \times 20 = 100$, and $11 \times 14 = 154$. A) -150 B) -30 C) 100 D) 154	
28. Since $1000/20 = 50$, 50 are multiples of 4 and 5. Since $1000/60 = 16.666 \dots$, 16 are also multiples of 6; $50 - 16 = 34$. A) 34 B) 42 C) 50 D) 58	
29. $\frac{3}{5} : 6 = (5 \times \frac{3}{5}) : (5 \times 6) = 3 : 30 = 1 : 10 = 8 : 80$. A) $\frac{20}{9}$ B) $\frac{9}{5}$ C) 24 D) 80	
30. If the average of these integers is 5, then their sum is 15, and the greatest possible value of the sum of their squares is $1^2 + 1^2 + 13^2 = 171$. A) 107 B) 149 C) 171 D) 197	
31. Suppose Cody walked 10 km in 2 hrs. yesterday. Then today she wants to walk 15 km in 1 hr. Since her rate yesterday was 5 km per hr. and her rate today is 15 km per hr., that's a 200% increase. A) 200% B) 300% C) 400% D) 500%	
32. $9^{18} - 3^{32} = 3^{36} - 3^{32} = 3^{32} \times (3^4 - 1) = 3^{32} \times 80 = 3^{32} \times 2^4 \times 5$. A) 5 B) 17 C) 19 D) 31	
33. $3 \times 6 \times 9 \times 12 \times 15 \times 18 = 2^4 \times 3^8 \times 5$; the factors that are perfect squares are $2^2, 2^4, 3^2, 3^4, 3^6, 3^8, 2^2 3^2, 2^2 3^4, 2^2 3^6, 2^2 3^8, 2^4 3^2, 2^4 3^4, 2^4 3^6$, and $2^4 3^8$. A) 15 B) 14 C) 7 D) 6	
34. Whatever box Bette checks 1st, the probs. are $\frac{2}{3}$ that she checks a different one on the 2nd form and $\frac{1}{3}$ that the 3rd form differs from the first two. So the final prob. is $\frac{2}{3} \times \frac{1}{3} = \frac{2}{9}$. A) $\frac{1}{4}$ B) $\frac{1}{3}$ C) $\frac{2}{9}$ D) $\frac{3}{10}$	
35. Each number in the sequence 105, 112, 119, ..., is a multiple of 7, and each number in the sequence 107, 114, 121, ..., is 2 more than a multiple of 7. Since 2137 is 2 more than a multiple of 7, it may appear in the sequence. A) 1296 B) 1648 C) 2137 D) 2818	

26.
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C

The end of the contest  8

Information & Solutions

2012-2013 Annual 8th Grade Contest

Tuesday, February 26 (alternate date: February 19), 2013

8

Directions for Grading

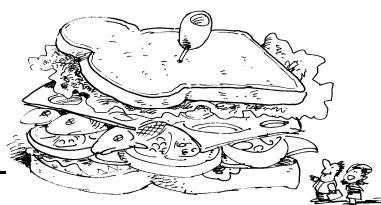
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- **Return of Student Papers** *Originals* of contest papers with scores of 30 or more *must* be held until June 1. *Copies* of these papers, and originals of all other papers, should be returned to students after grading. Students scoring 30 points or more must confirm an *understanding* of the contest rules by signing the *Selected Math League Rules* (on the colored sheet of information and rules that accompanied the contests). Keep this signed sheet with the original contests until June 1. Please do not mail these to the League unless we ask you to do so.

Eighteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6)*, and *High School (Vols. 1, 2, 3, 4, 5, 6)*, are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

2012-2013 8TH GRADE CONTEST SOLUTIONS

Answers

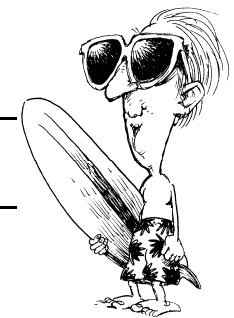
1. Since $1 + 4 + 1 + 4 = 10$, $(1 + 4 + 1 + 4) \times 1414 = 14140$. A) 10 B) 1010 C) 1414 D) 10000	1. C
2. Any number divisible by 2 and 5 ends in 0. Only 6660 ends in 0 and is also divisible by 3 and 4. A) 2345 B) 4567 C) 5550 D) 6660	2. D
3. $(25 + 4001) \div 2 = 2013$. A) 994 B) 1019 C) 1988 D) 4001	3. D
4. Bob rides his bicycle at 40 km per 60 minutes. In 30 minutes he rides 20 km, so in 3 minutes he rides 2 km. A) 1 km B) 2 km C) 3 km D) 4 km	4. B
5. There are 9 people in front of my brother, and there are 9 people behind me. That's 18 people. Counting my brother and me, that's a total of 20 people in line. A) 11 B) 19 C) 20 D) 21	5. C
6. Of every 5 books, 4 have hard covers. Since $60 \div 5 = 12$, there are 12 groups of 5 books each. Since $12 \times 4 = 48$, I have 48 hard covers. A) 48 B) 35 C) 15 D) 12	6. A
7. Since $111 = 1 \times 111$, the largest odd factor of 111 is 111. A) 3 B) 37 C) 109 D) 111	7. D
8. 100 pennies = \$1; 200 nickels = $200 \times 5\text{¢} = \$10$; 300 dimes = $300 \times 10\text{¢} = \30 ; and 400 quarters = $400 \times 25\text{¢} = \100 ; the coins' value is \$141. A) \$91 B) \$121 C) \$141 D) \$161	8. C
9. Multiply the last 3 digits of each: $789 \times 890 = 702210$; the hundreds digit is 2. A) 0 B) 1 C) 2 D) 3	9. C
10. Ben finds 2 eyes under 40% of the rocks. If he looks under 400 rocks, he will find $2 \times 0.4 \times 400 = 320$ eyes. A) 100 B) 160 C) 200 D) 320	10. D
11. $12 \times \frac{1}{2} \times \frac{1}{3} \times \frac{1}{4} \times \frac{1}{6} =$ A) $\frac{1}{144}$ B) $\frac{1}{12}$ C) 1 D) 12	11. B
12. If the measures of the angles of triangle T are in a 1:2:3 ratio, they must have measures 30° , 60° , and 90° . So T is a right triangle. A) acute B) obtuse C) right D) isosceles	12. C



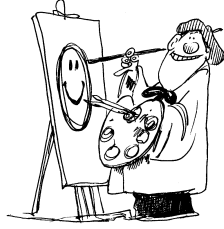
2012-2013 8TH GRADE CONTEST SOLUTIONS

Answers

13. $(9 + 8) \times 6 - 4 \div 2 = 17 \times 6 - 2 = 100$. A) $9 + 8 \times 6 - 4 \div 2$ B) $(9 + 8) \times 6 - 4 \div 2$ C) $9 + 8 \times (6 - 4) \div 2$ D) $(9 + 8) \times (6 - 4) \div 2$	13. B
14. The least common multiple of $2 \times 3 \times 3$, $2 \times 2 \times 7$, and 2×19 is $2 \times 2 \times 3 \times 3 \times 7 \times 19 = 4788$. Thus, Alex found 4788 diamonds. A) 2 B) 84 C) 4788 D) 19152	14. C
15. $0.07 + 0.007 = 0.077 = 0.700 - 0.623$. A) 0.623 B) 0.777 C) 0.784 D) 0.854	15. A
16. $2^2 \times 2^2 \times 2^2 + 2^2 \times 2^2 + 2^2 = 4 \times 4 \times 4 + 4 \times 4 + 4 = 64 + 16 + 4 = 84 = 2^2 \times 21$. A) 16 B) 21 C) 32 D) 33	16. B
17. Multiplying any whole number by 6 results in a product divisible by 3; after adding 5, the sum can no longer be divisible by 3 or 9. A) 5 B) 7 C) 9 D) 11	17. C
18. Divide 10000 hours by 24 hours per day to find that it is 416 days, 16 hours. The princess wakes 16 hours after 6:00 P.M., at 10:00 A.M. A) 10:00 A.M. B) 4:00 P.M. C) 8:00 P.M. D) 11:00 P.M.	18. A
19. Since $40\% + 1/3 = 2/5 + 1/3 = 11/15$, the remaining $4/15$ are the 60 metamorphic rocks. Hence $4:15 = 60:?$, and $? = 225$. A) 160 B) 180 C) 200 D) 225	19. D
20. The sum of 4 consecutive even integers is 148. Their average is 37. The 4 integers are 34, 36, 38, and 40. The sum of the digits of 34 is 7. A) 6 B) 7 C) 9 D) 12	20. B
21. Since $108 \div 9 = 12$, Max has $12 \times 2 = 24$ surfboards. A) 12 B) 24 C) 48 D) 486	21. B
22. $180 + 180 \times 1.5 = 180 + 270 = 450$. A) 270 B) 330 C) 450 D) 630	22. C
23. The longest side's length is < the sum of the other 2 sides. A possible longest side-length is 20. A) 15 B) 20 C) 25 D) 29	23. B
24. If $x \square y = (x + y)^2 - 2xy$, then $5 \square 7 = (5 + 7)^2 - 2 \times 5 \times 7 = 144 - 70 = 74$. A) 12 B) 24 C) 35 D) 74	24. D
25. A square of side-length 4π has perimeter 16π ; $C = \pi d$, so $d = 16$. A) 2 B) 4 C) 8 D) 16	25. D



26. Jacques, who paints only smiley faces, signs and numbers each of his paintings. If he started with Smiley #1 and has painted through Smiley #111, how many times has he used the digit 1 in his numbering?



26.

- A) 12 B) 22 C) 24 D) 36

27. How many whole numbers have squares that are between 2 and 200?

27.

- A) 12 B) 13 C) 24 D) 26

28. A baker cuts circular cookies out of a flat rectangle of cookie dough. If the rectangle is 2 m by 1 m, and the cookies have radius 10 cm, at most how many cookies can the baker cut from the sheet of dough?

28.

- A) 50 B) 63 C) 64 D) 200

29. 0.02% of 20% of ? = 200% of 2000

29.

- A) 1000 B) 100 000 C) 1 000 000 D) 100 000 000

30. A miner combines 1200 kg of ore that is on average 3% gold with 2400 kg of ore that is on average 6% gold. If the 100 kg containing the most gold of the 3600 kg is 40% gold, the remaining ore will be ? gold.

30.

- A) 2% B) 3% C) 4% D) 5%

31. Including face diagonals, the total number of diagonals of a cube is

31.

- A) 12 B) 14 C) 16 D) 24

32. How many odd 3-digit integers greater than 500 are composed of 3 different non-zero digits?

32.

- A) 154 B) 175 C) 185 D) 200

33. If I square all whole-number factors of 36 and multiply the resulting numbers, the product will be equal to

33.

- A) 36^2 B) 36^4 C) 36^8 D) 36^9

34. When the four members of the Beaverton family carry a log, each has a 0.02 probability of tripping, and each probability is independent of the others. What is the probability that they will carry the log without any of them tripping?



34.

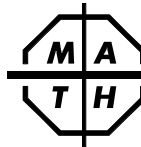
- A) $1 - (0.02)^4$ B) $(0.98)^4$ C) $(0.02)^4$ D) $1 - (0.98)^4$

35. What is the largest prime factor of the product of all even numbers from 2 through 200?

35.

- A) 47 B) 97 C) 199 D) 2019

The end of the contest 8



Sample 8th Grade Contest

Tuesday, February 19 (alternate date: February 26), 2019

8

Instructions

- **Time** Do *not* open this booklet until told by your teacher to begin. You might be *unable* to finish all 35 questions in the 30 minutes allowed.
- **Scores** Remember that *this is a contest, not a test*—there is no “passing” or “failing” score. Few students score 28 points (80% correct). Students with half that, 14 points, *should be commended!* High-scoring students may be invited to our “Math Camp” in July.
- **Results Posted Online** High-scoring contest results, both overall and regional, will be posted at *www.mathleague.com* no later than April 15.
- **Format, Point Value, & Eligibility** Every answer is an A, B, C, or D. Write answers in the *Answers* column. A correct answer is worth 1 point. Unanswered questions get no credit. You **may** use a calculator. You’re eligible for this contest only if you are in grade 8 or below and only if you don’t also take this year’s Annual 6th or Annual 7th Grade Contest.

Please Print (To the student: You must complete all items below)

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Time at Start of Contest _____ Today’s Date _____

Do Not Write In The Space Below

To the Teacher:

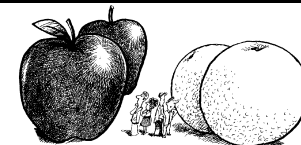
Please enter the score at the right before you return this paper to the student. *Papers with scores of 30 or higher must be held until June 1.* Student’s Score: _____

Twenty-one books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6, 7), Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6, 7), and High School (Vols. 1, 2, 3, 4, 5, 6, 7)* are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

1. $(4 \times 6 \times 8 \times 10) \div (6 \times 8 \times 10) =$ A) 3 B) 4 C) 12 D) $3 \times 6 \times 8 \times 10$	1.
2. $(2 \div 3)$ rounded to the nearest hundredth is A) 0.33 B) 0.66 C) 0.67 D) 0.70	2.
3. Baby Amy is one day older than Baby Barry. The product of their ages measured in days could be A) 33 B) 132 C) 245 D) 246	3.
4. (The largest even divisor of 200) \div (the largest odd divisor of 200) = A) 4 B) 8 C) 20 D) 200	4.
5. An equilateral triangle with integer side-lengths has a perimeter that is numerically equal to the area of a square. Which of the following could be the length of a side of the square? A) 12 B) 10 C) 8 D) 4	5.
6. I have only nickels, dimes, and quarters to pay for my dinner, which costs \$12.60. The smallest number of coins I can use to pay is A) 51 B) 52 C) 54 D) 55	6.
7. The smallest prime factor of 2019 is A) 1 B) 3 C) 19 D) 673	7.
8. The product of four consecutive integers must be divisible by each of the following <u>except</u> A) 4 B) 6 C) 10 D) 12	8.
9. There are <u>?</u> hours in 4 weeks. A) 48 B) 96 C) 336 D) 672	9.
10. If I divide my favorite number by its reciprocal, the quotient is 10 times as large as my favorite number. My favorite number is A) $\frac{1}{10}$ B) $\frac{1}{5}$ C) $\frac{1}{2}$ D) 10	10.
11. The height of the smoke from my barbecue is 100000 cm, which is the same as <u>?</u> km. A) 1 B) 10 C) 100 D) 1000	11.
12. If the degree measures of the angles of a triangle are in a 4:5:6 ratio, what is the difference between the measures of the largest and the smallest angles? A) 12° B) 24° C) 30° D) 36°	12.



13. The population of a town started at 1000, then went up 10%, then down 20%, then back up 10%. The population of the town ended at A) 968 B) 972 C) 1000 D) 1024	13.
14. In my orchard, there are 60 more apples than oranges, and 5 times as many apples as oranges. How many apples are there? A) 50 B) 75 C) 100 D) 125	14.
15. A polygon in which every pair of angles is supplementary <u>must</u> be a A) triangle B) square C) rectangle D) hexagon	15.
16. Which of the following is smallest in value? A) 2^{600} B) 3^{500} C) 4^{400} D) 5^{300}	16.
17. $(2^{100} \times 4^{50}) \div 2 =$ A) 2^{75} B) 2^{100} C) 2^{149} D) 2^{199}	17.
18. What is the remainder when 3^{333} is divided by 10? A) 1 B) 3 C) 7 D) 9	18.
19. On a series of tests, Gus got 100 once, 90 twice, and 80 five times. What was his average score for all of the tests? A) 80 B) 85 C) 90 D) 92	19.
20. The product of the thousands and tenths digits of 1234.5678 is A) 5 B) 10 C) 35 D) 40	20.
21. The probability of heads then tails then heads on 3 tosses of a coin is A) 0.125 B) 0.25 C) 0.375 D) 0.5	21.
22. On January 1 last year, Rui got a jar of jellybeans. On each day he ate the same number of jellybeans. He counted 560 on January 31 before eating any and he counted 380 on March 17 before eating any. There were <u>?</u> jellybeans in the jar when Rui got it. A) 600 B) 650 C) 680 D) 740	22.
23. Jake used 120 boxes of tissues in 3 days! There are 144 tissues per box. That's <u>?</u> tissues per minute! A) 2 B) 3 C) 4 D) 5	23.
24. The number 5184 has <u>?</u> positive odd divisors. A) 1 B) 2 C) 4 D) 5	24.
25. The sum of 5 consecutive even integers could be A) 120 B) 125 C) 164 D) 212	25.



26. From 1 to 9 is one 1; from 10 to 19 is 11 1s; from 20 to 99 is 8 1s; from 100 to 109 is 11 1s, and from 110 to 111 is 5 1s. All together, we have $(1 + 11 + 8 + 11 + 5)$ 1s. That is a total of 36 1s.

A) 12 B) 22 C) 24 D) 36

27. The whole numbers with squares between 2 and 200 are 2, 3, 4, 5, . . . , 13, and 14. There are 13.

A) 12 B) 13 C) 24 D) 26

28. A baker is cutting circular cookies out of a flat rectangle of cookie dough. If the rectangle is 200 cm by 100 cm and the cookies have diameter 20 cm, the baker can cut 10 rows, with 5 cookies in each row.

A) 50 B) 63 C) 64 D) 200

29. 0.02% of $20\% = 0.00004$; 200% of $2000 = 4000 = 0.00004 \times 100\,000\,000$.

A) 1000 B) 100 000 C) 1 000 000 D) 100 000 000

30. Since 3% of 1200 kg plus 6% of 2400 kg is 180 kg, and 40% of 100 kg is 40 kg, the remaining 3500 kg of ore has 140 kg of gold. Since 140 divided by $3500 = 0.04$, the remaining ore will be 4% gold.

A) 2% B) 3% C) 4% D) 5%

31. There are 12 face diagonals and 4 diagonals passing through the interior.

A) 12 B) 14 C) 16 D) 24

32. Pick the hundreds digit, then the ones digit, then the tens digit. Based on the hundreds digit being even or odd, the count is $3 \times 4 \times 7 + 2 \times 5 \times 7$.

A) 154 B) 175 C) 185 D) 200

33. The whole-number factors of 36 are 1 and 36, 2 and 18, 3 and 12, 4 and 9, and 6. The product of their squares is 36^9 .

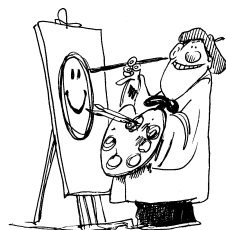
A) 36^2 B) 36^4 C) 36^8 D) 36^9

34. When the four members of the Beaverton family carry a log, each has a probability of **not** tripping of 0.98 . The probability of none of them tripping is $0.98 \times 0.98 \times 0.98 \times 0.98 = (0.98)^4$.

A) $1 - (0.02)^4$ B) $(0.98)^4$ C) $(0.02)^4$ D) $1 - (0.98)^4$

35. The largest prime factor of the product of all even numbers from 2 to 200 is the largest prime less than $200 \div 2 = 100$, which is 97.

A) 47 B) 97 C) 199 D) 2019



26.

D

27.

B

28.

A

29.

D

30.

C

31.

C

32.

A

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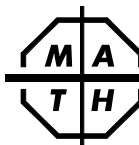
D

34.

B

35.

B



Information & Solutions

8

Tuesday, February 19 (alternate date: February 26), 2019

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- Awards & Results** The original contest package contained 5 *Certificates of Merit*—1 each for the 3 highest scoring students on the contest, plus extras for ties. **Do you need more Certificates of Merit?** If so, include your name, school, and school mailing address in a letter to: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**, and include a self-addressed, stamped envelope (**three 1st Class stamps req’d.**) large enough to hold certificates. Only scores submitted to our Internet Score Report Center by Fri., March 9, 2018 can be used in our *Summary of Contest Results newsletter*, which will be posted online no later than Fri., April 12, 2019.
- Return of Student Papers** *Originals* of contest papers with scores of 30 or more *must* be held until June 1. *Copies* of these papers, and originals of all other papers, should be returned to students after grading. Students scoring 30 points or more must confirm an *understanding* of the contest rules by signing the *Selected Math League Rules* (on the colored sheet of information and rules that accompanied the contests). Keep this signed sheet with the original contests until June 1. Please do not mail these to the League unless we ask you to do so.

Twenty-one books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6, 7)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6, 7)*, and *High School (Vols. 1, 2, 3, 4, 5, 6, 7)* are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

The end of the contest 8

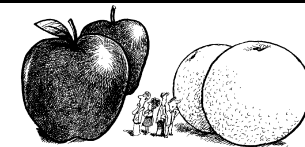
Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Adam Raichel, contest authors

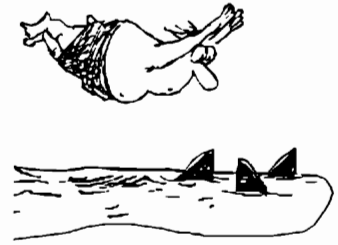
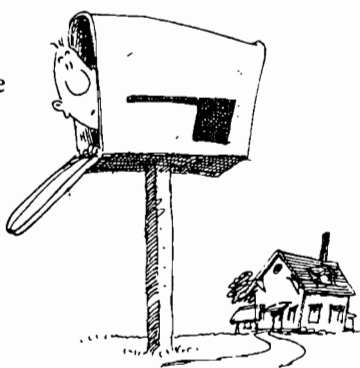
1. $(4 \times 6 \times 8 \times 10) \div (6 \times 8 \times 10) = 4 \times 1 \times 1 \times 1 = 4$. A) 3 B) 4 C) 12 D) $3 \times 6 \times 8 \times 10$	1. B
2. $2 \div 3 = 0.666\dots$; this rounds to 0.67. A) 0.33 B) 0.66 C) 0.67 D) 0.70	2. C
3. Their ages in days are consecutive integers. Since $132 = 11 \times 12$, the product of their ages in days could be 132. A) 33 B) 132 C) 245 D) 246	3. B
4. The largest even divisor of 200 is 200, and the largest odd divisor of 200 is 25; $200 \div 25 = 8$. A) 4 B) 8 C) 20 D) 200	4. B
5. An equilateral triangle with integer side-lengths has a perimeter that is a multiple of 3. The area of the square must also be a multiple of 3. If the length of a side of the square is 12, its area is 144. A) 12 B) 10 C) 8 D) 4	5. A
6. We can pay \$12.50 using 50 quarters. That leaves \$0.10, which I can pay using one dime. The smallest number of coins is 51. A) 51 B) 52 C) 54 D) 55	6. A
7. Since the sum of the digits of 2019 is divisible by 3, 2019 is also. A) 1 B) 3 C) 19 D) 673	7. B
8. Since it is possible that the four integers do not include a multiple of 5, their product might not be divisible by a multiple of 5. A) 4 B) 6 C) 10 D) 12	8. C
9. There are 28 days in 4 weeks. There are 24×28 hours in 28 days. A) 48 B) 96 C) 336 D) 672	9. D
10. Try each choice and find the correct one. Since 10 divided by $1/10$ is 100, choice D is correct. A) $\frac{1}{10}$ B) $\frac{1}{5}$ C) $\frac{1}{2}$ D) 10	10. D
11. The height of the smoke is 100000 cm. To convert to km, divide by $10^2 \times 10^3 = 10^5$. A) 1 B) 10 C) 100 D) 1000	11. A
12. Since $180^\circ \div (4 + 5 + 6) = 180^\circ \div (15) = 12^\circ$, the measures are $4 \times 12^\circ = 48^\circ$, $5 \times 12^\circ = 60^\circ$, and $6 \times 12^\circ = 72^\circ$. Finally, $72^\circ - 48^\circ = 24^\circ$. A) 12° B) 24° C) 30° D) 36°	12. B



13. The population of a town started at 1000, then went up to 1100, then down to 880, then up to 968. A) 968 B) 972 C) 1000 D) 1024	13. A
14. Divide each choice by 5. The quotients are 10, 15, 20, and 25. Since $15 + 60$ is 75, choice B is correct. A) 50 B) 75 C) 100 D) 125	14. B
15. Each pair of angles in any rectangle is supplementary. A) triangle B) square C) rectangle D) hexagon	15. C
16. Drop the zeroes and evaluate: choices become 64, 243, 256, and 125. A) 2^{600} B) 3^{500} C) 4^{400} D) 5^{300}	16. A
17. $(2^{100} \times 4^{50}) \div 2 = (2^{100} \times 2^{100}) \div 2 = 2^{200} \div 2^1 = 2^{199}$. A) 2^{75} B) 2^{100} C) 2^{149} D) 2^{199}	17. D
18. The pattern for the ones digits of powers of 3 is 39713971..., and the 333rd digit is 3. A) 1 B) 3 C) 7 D) 9	18. B
19. On a series of tests, Gus got 100 once, 90 twice, and 80 five times. The total of these 8 tests is 680, and the average is 85. A) 80 B) 85 C) 90 D) 92	19. B
20. The product of 1 and 5 is 5. A) 5 B) 10 C) 35 D) 40	20. A
21. The probability of heads then tails then heads is $0.5 \times 0.5 \times 0.5 = 0.125$. A) 0.125 B) 0.25 C) 0.375 D) 0.5	21. A
22. There are 45 days from January 31 through March 16. Rui ate 180 jellybeans in those 45 days, or 4 jellybeans each day. There are 30 days from January 1 through January 30. Rui ate 120 jellybeans on those days, so Rui had $560 + 120$ jellybeans on January 1. A) 600 B) 650 C) 680 D) 740	22. C
23. Jake used 40 boxes of tissues a day or 5760 tissues. Since $5760 \div 24 = 240$, he used 240 per hour or 4 per minute. A) 2 B) 3 C) 4 D) 5	23. C
24. $5184 = 64 \times 81$; its odd divisors are 1, 3, 9, 27, and 81. A) 1 B) 2 C) 4 D) 5	24. D
25. Only choice A is an even multiple of 5. A) 120 B) 125 C) 164 D) 212	25. A



23. $\sqrt{16^{16}} =$ A) 16^8 B) 16^4 C) 4^8 D) 4^4	23.
24. If a circle's area is 3600π , then its circumference is A) 60 B) 60π C) 120 D) 120π	24.
25. The cheapest way to move is by mail, so each time I move, I mail myself to my new home. I've done this as many times as the number of different integers that satisfy $(n^2-1)(n^2-2)(n^2-3) = 0$. How many times did I move by mail? A) 1 B) 2 C) 3 D) 6	25.
26. $\frac{1}{x} + \frac{1}{y} + \frac{1}{xy} = \frac{?}{xy}$ A) 2 B) 3 C) $x+y+1$ D) $x+y$	26.
27. If the sum of the squares of two numbers is equal to the square of their sum, then the product of these two numbers must be A) 0 B) 1 C) 4 D) 16	27.
28. $[(x+1)^2+(x+2)^2+(x+3)^2] - [(x^2+1^2)+(x^2+2^2)+(x^2+3^2)] =$ A) 0 B) $6x$ C) $9x$ D) $12x$	28.
29. The number of fish that swam with me is the sum of the digits of the largest integer x which satisfies $\frac{x}{x+1} < \frac{2004}{2005}$. How many fish swam with me? A) 4 B) 5 C) 6 D) 7	29.
30. For how many different integral values of b are both roots of $x^2+bx-16 = 0$ integers? A) 3 B) 4 C) 5 D) 6	30.



The end of the contest **A**

Visit our Web site at <http://www.mathleague.com>
 Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors



Sample Algebra I Contest

Spring, 2005

Instructions

A

- Time** Do *not* open this booklet until you are told by your teacher to begin. You will have only *30 minutes* working time for this contest. You might be *unable* to finish all 30 questions in the time allowed.
- Scores** Please remember that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 24 points (80% correct). Students with half that, 12 points, *should be commended!*
- Format and Point Value** This is a multiple-choice contest. Each answer will be one of the *capital letters* A, B, C, or D. Write each answer in the *Answer Column* to the right of each question. We suggest (but do not require) that you use a pencil. Each question you answer correctly is worth 1 point. Unanswered questions receive no credit. You **may** use a calculator *unless* your school does *not* allow you to use one.

Please Print

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Do Not Write In The Space Below

To the Teacher:
 Please enter the student's score at the right before you return this paper to the student. **Student's Score:** _____

The school's top scorer will receive the book *Math Contests—High School (Vol. 3)*. Other high scorers will receive Certificates of Merit. In any one school year, no student may win both a book and a certificate. The book and certificates were in the original contest package.

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1. $1^{2005} + 1^{2005} =$
A) 1^{4010} B) 2^1 C) 2^{2005} D) 2^{4010}

2. From n piles of 12 coconuts each, I am able to make $?$ piles of 3 coconuts each.
A) $n+3$ B) $n+4$ C) $3n$ D) $4n$

3. $x^{400} \div x^{100} =$
A) x^{500} B) x^{300} C) x^4 D) 4

4. $(-1)^1 + (-1)^2 + (-1)^3 + \dots + (-1)^{98} + (-1)^{99} =$
A) 1 B) 0 C) -1 D) -99

5. If $x^2 - y^2 = 10$, and $x + y = 10$, then $x - y =$
A) 1 B) -1 C) 10 D) -10

6. The total value of $2x$ nickels and x dimes is 60¢ when $x =$
A) 6 B) 4 C) 3 D) 2

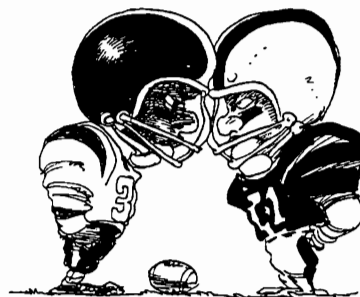
7. The least common multiple of 2, 4, and 8 is
A) 2 B) 8 C) 16 D) 64

8. $2 = \sqrt{8} \div ?$
A) 4 B) $\sqrt{6}$ C) $\sqrt{4}$ D) $\sqrt{2}$

9. There are 6 more football players wearing dark helmets than wearing light ones. The ratio of dark helmets to light is 2:1. The number of light helmets is
A) 2 B) 3 C) 6 D) 12

10. The graph of $?$ is parallel to the graph of $2x + y = -3$.
A) $2x + y = 3$ B) $2x + 4y = 6$ C) $2x - y = 3$ D) $x + 2y = -3$

11. Of 5 consecutive integers whose average is x , the smallest is
A) $x-2$ B) $x-3$ C) $x-4$ D) $x-5$



12. Of 5 consecutive *even* integers whose average is x , the smallest is
A) $x-2$ B) $x-3$ C) $x-4$ D) $x-5$

13. The greatest common factor of 2^{2004} and 2^{2005} is
A) 1 B) 2 C) 2^{2004} D) 2^{2005}

14. I ran away with a big prize when I was the 7th caller to know that the slope of every horizontal line is
A) 0 B) 1 C) -1 D) nonexistent

15. If 10% of a is b , then $a =$
A) $0.1b$ B) b C) $9b$ D) $10b$

16. For which of the following is n^n the square of an integer?
A) $n = 3$ B) $n = 5$ C) $n = 6$ D) $n = 7$

17. If $k = ?$, then the two roots of $x^2 + 4x + k = 0$ are equal.
A) 1 B) 2 C) 3 D) 4

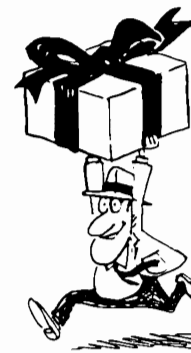
18. Jesse has worn the same hat for d years. If he wears it for 12 more years, he will have worn this hat for d^2 years. For how many years has Jesse worn this hat?
A) 4 B) 6 C) 8 D) 12

19. $|x| + |-x| =$
A) 0 B) $|x|$ C) $|-x|$ D) $2|x|$

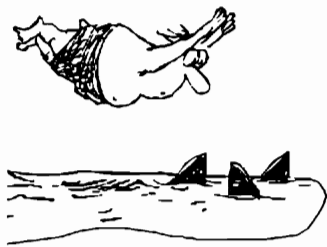
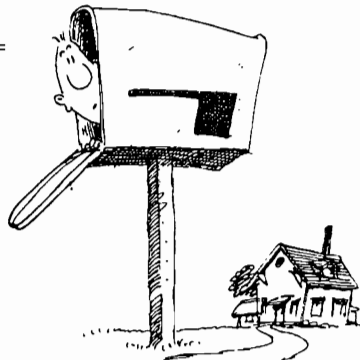
20. Circle C 's center is $(0,0)$, and the length of C 's radius is 5. Which of the following are the coordinates of a point on C ?
A) $(0,5)$ B) $(-5,-5)$ C) $(-10,0)$ D) $(5,5)$

21. For primes a and b , if $a > b$, then ab has $?$ unequal positive factors.
A) 4 B) 3 C) 2 D) 1

22. The product of $?$ and x^{100} has the same value as $(-x)^{100}$.
A) 100 B) 1 C) -1 D) -100



<p>23. $\sqrt{16^{16}} = \sqrt{(16^8)^2} = 16^8$. A) 16^8 B) 16^4 C) 4^8 D) 4^4</p>	<p>23. A</p>
<p>24. $A = \pi r^2 = 3600\pi$, so $r^2 = 3600$, or $r = 60$. $C = 2\pi r$, so $C = 120\pi$. A) 60 B) 60π C) 120 D) 120π</p>	<p>24. D</p>
<p>25. If $(n^2-1)(n^2-2)(n^2-3) = 0$, then $n^2-1 = 0$, or $n^2-2 = 0$, or $n^2-3 = 0$. Therefore, $n^2 = 1$, or $n^2 = 2$, or $n^2 = 3$. The only integers which satisfy any of these equations are 1 and -1. The number of times I moved by mail is 2. A) 1 B) 2 C) 3 D) 6</p>	<p>25. B</p>
<p>26. $\frac{y}{xy} + \frac{x}{xy} + \frac{1}{xy} = \frac{x+y+1}{xy}$. A) 2 B) 3 C) $x+y+1$ D) $x+y$</p>	<p>26. C</p>
<p>27. If $x^2 + y^2 = (x + y)^2$, then $x^2 + y^2 = x^2 + 2xy + y^2$. Thus, $2xy = 0$, so $xy = 0$. A) 0 B) 1 C) 4 D) 16</p>	<p>27. A</p>
<p>28. $(x^2+2x+1)+(x^2+4x+4)+(x^2+6x+9)-[(x^2+1)+(x^2+4)+(x^2+9)] = 12x$. A) 0 B) $6x$ C) $9x$ D) $12x$</p>	<p>28. D</p>
<p>29. Using $x > 0$, $\frac{x}{x+1} < \frac{2004}{2005} \Leftrightarrow x < 2004$. The largest integral solution is $x = 2003$. The sum of the digits of 2003 is 5, so I swam with 5 fish.</p>	<p>29. B</p>
<p>30. There are 5 ways to factor -16 into 2 integral factors (-16×1, -8×2, -4×4, -2×8, and -1×16). Their sum is the value of b. A) 3 B) 4 C) 5 D) 6</p>	<p>30. C</p>



The end of the contest **A**

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 Steven R. Conrad, Daniel Flegler, and Jeannine Kolbush, contest authors



Information & Solutions

Spring, 2005

Directions for Grading

A

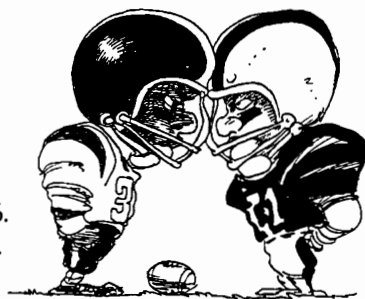
- Date** You may give this contest anytime after April 15. The *Algebra Course 1 Contest* is for use in your own school or district. We've enclosed a registration form for next year. Since results are *not* used for interschool comparisons, **we do not enclose a score report form**.
- Urgent questions?** Call 1-201-568-6328.
- Scores** Remind students that *this is a contest, not a test*—and there is no “passing” or “failing” score. Few students score as high as 24 points (80% correct); students with half that, 12 points, *should be commended!*
- Solutions** Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- Awards** The original contest package contained 1 book award (and a bookplate you should affix to the book's inside front cover) for the 1st place student. We also enclosed 5 *Certificates of Merit*—1 each for the runner-up on each grade level, plus extras for ties.
- Additional Book Awards & Additional Certificates** To give more than 1 book award, you may purchase additional books as described below. Do you need more Certificates of Merit? If so, send your name, school, and school mailing address to our mailer at: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**, and include a self-addressed, stamped envelope (2 stamps required) large enough to hold certificates.

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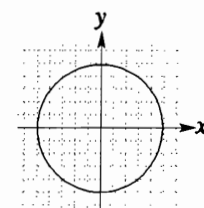
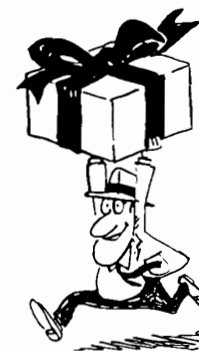
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1. $1^{2005} + 1^{2005} = 1 + 1 = 2 = 2^1$.
 A) 1^{4010} B) 2^1 C) 2^{2005} D) 2^{4010}
2. n piles of 12 coconuts each = $(12n)$ coconuts = $(3 \times 4n)$ coconuts = $4n$ piles of 3 coconuts each.
 A) $n+3$ B) $n+4$ C) $3n$ D) $4n$
3. $x^{400} \div x^{100} = x^{(400 - 100)} = x^{300}$.
 A) x^{500} B) x^{300} C) x^4 D) 4
4. $(-1)^1 + (-1)^2 + \dots + (-1)^{99} = (-1) + (1) + \dots + (-1) = 0 + \dots + (-1) = -1$.
 A) 1 B) 0 C) -1 D) -99
5. Since $x^2 - y^2 = (x+y)(x-y) = 10(x-y) = 10$, we see that $x-y = 1$.
 A) 1 B) -1 C) 10 D) -10
6. Since $(2x)(5\text{¢}) + (x)(10\text{¢}) = 60\text{¢}$, add to get $20x\text{¢} = 60\text{¢}$, so $x = 3$.
 A) 6 B) 4 C) 3 D) 2
7. Since 8 is divisible by both 2 and 4, the l.c.m. of all three is 8.
 A) 2 B) 8 C) 16 D) 64
8. $2 = \sqrt{4} = \sqrt{8/2} = \sqrt{8} \div \sqrt{2}$.
 A) 4 B) $\sqrt{6}$ C) $\sqrt{4}$ D) $\sqrt{2}$
9. If $h = \#$ of light helmets, then $2h = \#$ of dark helmets. There are 6 more dark helmets than light ones, so $2h - h = 6$, or $h = 6$. The number of light helmets is 6.
 A) 2 B) 3 C) 6 D) 12
10. Any 2 lines of the form $2x + y = k$, with unequal k 's, are parallel.
 A) $2x + y = 3$ B) $2x + 4y = 6$ C) $2x - y = 3$ D) $x + 2y = -3$
11. The average is x , so the integers are $x-2, x-1, x, x+1$, and $x+2$.
 A) $x-2$ B) $x-3$ C) $x-4$ D) $x-5$



12. The average is x , so the integers are $x-4, x-2, x, x+2$, and $x+4$.
 A) $x-2$ B) $x-3$ C) $x-4$ D) $x-5$
13. 2^{2004} is a factor of 2^{2005} , so 2^{2004} is the g.c.f.
 A) 1 B) 2 C) 2^{2004} D) 2^{2005}
14. A horizontal line is parallel to the x -axis. I was the 7th caller to know that the slope of any such line is 0.
 A) 0 B) 1 C) -1 D) nonexistent
15. $a = 100\%$ of $a = 10 \times 10\%$ of $a = 10b$.
 A) $0.1b$ B) b C) $9b$ D) $10b$
16. When $n = 6, n^n = 6^6 = (6^{6/2})^2 = (6^3)^2$, which is the square of 6^3 .
 A) 3 B) 5 C) 6 D) 7
17. If $k = 4$, then $x^2 + 4x + 4 = (x+2)(x+2) = 0$ and $x = -2$ or -2 .
 A) 1 B) 2 C) 3 D) 4
18. Jesse has worn the same hat for d years. If he wears it for 12 more years, he will have worn this hat for d^2 years. So, $d+12 = d^2$, or $(d+3)(d-4) = 0$. Since $d > 0, d = 4$.
 A) 4 B) 6 C) 8 D) 12
19. $|x| + |-x| = |x| + |x| = 2|x|$.
 A) 0 B) $|x|$ C) $|-x|$ D) $2|x|$
20. Sketch circle C. Of the choices, only choice A, (0,5), is on circle C.
 A) (0,5) B) (-5,-5) C) (-10,0) D) (5,5)
21. The 4 positive factors of ab are 1, a, b , and ab .
 A) 4 B) 3 C) 2 D) 1
22. Since $(-x)^{100} = (-1)^{100}(x^{100}) = 1 \times x^{100}$, choice B is correct.
 A) 100 B) 1 C) -1 D) -100



23. If $(x - 2)^2 = 1600$, which of the following could be the value of $x - 4$?
 A) -42 B) -34 C) 34 D) 36

23.

24. If x is a positive integer, and the product of all integers from 1 to x , inclusive, is a multiple of 260, then the least possible value of x is
 A) 10 B) 13 C) 26 D) 30

24.

25. Don Q rides at $3r$ kph for the first 60 km of a trip, and then rides at $6r$ kph for the next 60 km. What is his average speed for the entire trip?
 A) $4r$ B) $4.5r$ C) $5r$ D) $5.5r$

25.

26. If I reverse the digits of a two-digit positive integer and subtract the resulting integer from the original integer, the difference is 36. The difference between the two digits is
 A) 4 B) 6 C) 8 D) 9

26.

27. My sister has s dollars, and I have d dollars more than she has. If together we have a total of t dollars, which of the following is equivalent to s ?
 A) $t - 2d$ B) $\frac{t}{2} - d$ C) $t - \frac{d}{2}$ D) $\frac{t-d}{2}$

27.

28. If x is an integer, which of the following must be divisible by 3?
 A) $x(x - 3)(x - 6)$ B) $x(x + 3)(x - 3)$ C) $x(x + 7)(x - 2)$ D) $x(x + 1)(x - 1)$

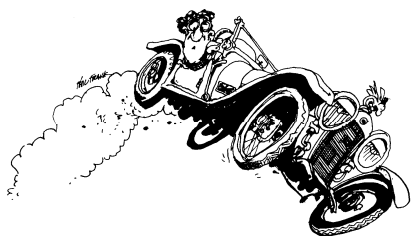
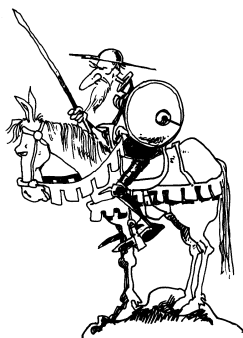
28.

29. If $x \neq 0$ or 1, and each x in the expression $\frac{2x+1}{3x-3}$ is replaced by $\frac{4}{x}$, then the resulting expression is equivalent to
 A) $\frac{2x+1}{3x-3}$ B) $\frac{3x-3}{2x+1}$ C) $\frac{8+x}{12-3x}$ D) $\frac{12x-3}{8x+1}$

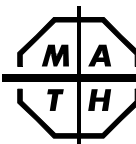
29.

30. The number of passengers in my car is the same as the number of integers less than 8 that satisfy $\frac{(x+3)(x+4)}{x-5} \geq 0$. My car has ? passengers.
 A) 2 B) 3 C) 4 D) 5

30.



The end of the contest **A**



Sample Algebra I Contest

A

Spring, 2013

Instructions

- **Time** Do *not* open this booklet until you are told by your teacher to begin. You will have only *30 minutes* working time for this contest. You might be *unable* to finish all 30 questions in the time allowed.
- **Scores** Please remember that *this is a contest, and not a test*—there is no “passing” or “failing” score. Few students score as high as 24 points (80% correct). Students with half that, 12 points, *should be commended!*
- **Format and Point Value** This is a multiple-choice contest. Each answer will be one of the *capital letters* A, B, C, or D. Write each answer in the *Answer Column* to the right of each question. We suggest (but do not require) that you use a pencil. Each question you answer correctly is worth 1 point. Unanswered questions receive no credit. You **may** use a calculator *unless* your school does *not* allow you to use one.

Please Print

Last Name _____ First Name _____

School _____ Teacher _____ Grade Level _____

Do Not Write In The Space Below

To the Teacher:

Please enter the student’s score at the right before you return this paper to the student.

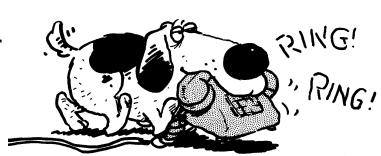
Student’s Score: _____

Eighteen books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6)*, and *High School (Vols. 1, 2, 3, 4, 5, 6)*, are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

2012-2013 ALGEBRA COURSE 1 CONTEST

Answers

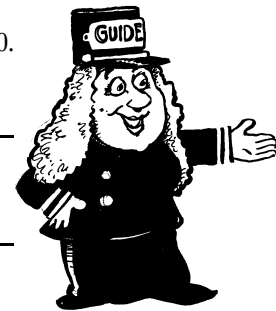
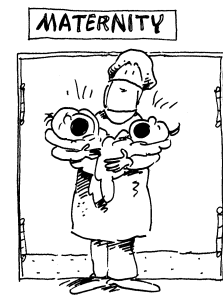
1. If $x = 2013$, then $(x - 2012)^{(x - 2013)} =$ A) 0 B) 1 C) 2 D) 10	1.
2. If $a = 5$, then $4a^3 - 3a^2 + 2a - 1 =$ A) 39 B) 125 C) 434 D) 586	2.
3. Fred and Ginger danced for $\frac{2013}{x}$ hours last year. If they danced for a whole number of hours, then x cannot be A) 3 B) 11 C) 13 D) 61	3.
4. Which of the following is a factor of $x^2 - 4x - 12$? A) $x + 2$ B) $x - 2$ C) x D) $x - 8$	4.
5. $2^{400} + 2^{400} =$ A) 2^{401} B) 2^{800} C) 4^{400} D) 4^{800}	5.
6. If $\frac{p}{q} = \frac{2}{3}$, then $\frac{-p}{-q} =$ A) $-\frac{2}{3}$ B) $\frac{-2}{3}$ C) $\frac{2}{-3}$ D) $\frac{2}{3}$	6.
7. The number of 5 kg weights and 10 kg weights I have is $4w$ and $2w$, respectively. If my weights all together weigh 200 kg, then $w =$ A) 4 B) 5 C) 10 D) 20	7.
8. $(3x^3 - 4x^2) + (2x^2 - 3x) - (3x^3 - 4) =$ A) $2x^2 - 3x - 4$ B) $2x^2 - 3x + 4$ C) $-2x^2 - 3x - 4$ D) $-2x^2 - 3x + 4$	8.
9. If $3x - 4$ is odd, then $3x + 10$ must be A) positive B) prime C) odd D) even	9.
10. Telly the dog grabs the phone when it rings. Yesterday it rang at 4 PM or later 80% of the time it rang, and it rang 50 times before 4 PM. The phone rang <u>?</u> times yesterday. A) 200 B) 250 C) 300 D) 400	10.
11. The ages of 5 sequoia trees in a forest are consecutive even integers. If the total of the trees' ages is 4440 years, the oldest tree is <u>?</u> old. A) 884 years B) 888 years C) 890 years D) 892 years	11.



2012-2013 ALGEBRA COURSE 1 CONTEST

Answers

12. A straight line that passes through the points (p, q) and $(2p, 3q)$ must also pass through the point A) $(3p, 4q)$ B) $(3p, 5q)$ C) $(4p, 6q)$ D) $(4p, 8q)$	12.
13. What is the product of all multiples of 3 between -9 and 12? A) -314928 B) -2916 C) 0 D) 2916	13.
14. Of children born at the maternity ward yesterday, the ratio of boys to girls was $3x:4y$, which is also 5:6. The ratio $x:y$ is A) 10:9 B) 24:15 C) 15:24 D) 4:5	14.
15. $\frac{(x^{200})^{400}}{(x^{100})^{200}} =$ A) x^4 B) x^6 C) x^{40000} D) x^{60000}	15.
16. If the average of x, y , and z is 16 and the average of x and y is 12, then $z =$ A) 4 B) 14 C) 20 D) 24	16.
17. If n is a prime > 5 , the least common multiple of $6n^8$ and $10n^{12}$ is A) $2n^8$ B) $30n^{12}$ C) $30n^{24}$ D) $60n^{96}$	17.
18. A square is inscribed in a circle. If the perimeter of the square region is 64, what is the area of the circle? A) 16π B) 32π C) 64π D) 128π	18.
19. If $x - y = 3$ and $x^2 + y^2 = 485$ then $xy =$ A) 162 B) 238 C) 482 D) 3880	19.
20. Gilda the guide has a lucky number that is the sum of all the roots of $(x-1)(x+2)(x-3) \times \dots \times (x-19)(x+20)(x-21) = 0$. Gilda's lucky number is A) 10 B) 11 C) 21 D) 31	20.
21. $ 4x + 4 -x =$ A) 0 B) 8 C) $8 x $ D) $4 4x $	21.
22. $\sqrt{36^{64}} =$ A) 6^8 B) 6^{32} C) 36^8 D) 36^{32}	22.



23. If $(x - 2)^2 = 1600$, $x - 2 = \pm 40$. Thus $x = 42$ or -38 , and $x - 4 = 38$ or -42 .
 A) -42 B) -34 C) 34 D) 36

23.
A

24. Since the prime factorization of 260 is $(2)(2)(5)(13)$, the least possible value of x is 13.

A) 10 B) 13 C) 26 D) 30

24.
B

25. Avg. speed = (total dist./total time), so Don Q's avg. speed is $(60 + 60)/[60/(3r) + 60/(6r)] = 120/(30/r) = 4r$.

A) $4r$ B) $4.5r$ C) $5r$ D) $5.5r$

25.
A

26. If the integer is $10t + u$, then the difference between this integer and the integer with the digits reversed is $(10t + u) - (10u + t) = 9t - 9u = 36$. Dividing by 9, $t - u = 4$.

A) 4 B) 6 C) 8 D) 9

26.
A

27. My sister has s dollars, and I have d dollars more than she has. If together we have a total of t dollars, then $s + (s + d) = t$, so $2s = t - d$ and $s = (t - d)/2$.

A) $t - 2d$ B) $\frac{t}{2} - d$ C) $t - \frac{d}{2}$ D) $\frac{t - d}{2}$

27.
D

28. Choice D is the product of 3 consecutive integers, so it's divisible by 3.

A) $x(x - 3)(x - 6)$ B) $x(x + 3)(x - 3)$ C) $x(x + 7)(x - 2)$ D) $x(x + 1)(x - 1)$

28.
D

29. The expression $\frac{2x+1}{3x-3}$ becomes $\frac{2(\frac{4}{x})+1}{3(\frac{4}{x})-3} = \frac{\frac{8}{x}+1}{\frac{12}{x}-3} = \frac{8+x}{12-3x}$.

A) $\frac{2x+1}{3x-3}$ B) $\frac{3x-3}{2x+1}$ C) $\frac{8+x}{12-3x}$ D) $\frac{12x-3}{8x+1}$

29.
C

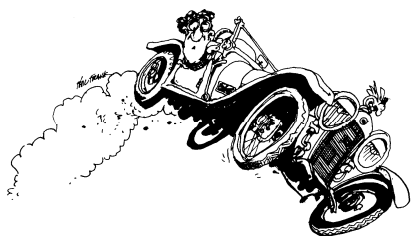
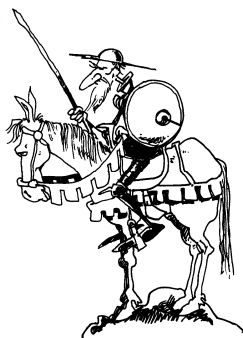
30. The inequality is true if $x = -3$ or -4 . If $x < -4$ or $-3 < x < 5$, it is false. If $x = 6$ or 7 , it is true.

$$\frac{(x+3)(x+4)}{x-5} \geq 0.$$

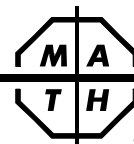
My car has 4 passengers.

A) 2 B) 3 C) 4 D) 5

30.
C



The end of the contest **A**



Information & Solutions

Spring, 2013

Directions for Grading

A

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- Urgent questions?** Write to comments@mathleague.com, or call 1-201-568-6328 or 1-516-365-5656.
- Scores** Remind students that *this is a contest, and not a test*—there is no "passing" or "failing" score. Few students score as high as 24 points (80% correct); students with half that, 12 points, *should be commended!*
- Solutions** Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- Awards** The original contest package contained 1 book award (and a bookplate you should affix to the book's inside front cover) for the 1st place student. We also enclosed 5 *Certificates of Merit*—1 each for the runner-up on each grade level, plus extras for ties.
- Additional Book Awards & Additional Certificates** If you want to give more than 1 book award, you may purchase additional books as described below. Do you need more Certificates of Merit? If so, send your name, school, and school mailing address to our mailer at: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**. Include a self-addressed, stamped envelope (**2 stamps required**) large enough to hold certificates.

The school's top scorer will receive the book *Math Contests—High School (Vol. 4)*. Other high scorers will receive Certificates of Merit. In any one school year, no student may win both a book and a certificate. The book and certificates were in the original contest package.

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Visit our Web site at <http://www.mathleague.com>

Steven R. Conrad, Daniel Flegler, and Adam Raichel, contest authors

2012-2013 ALGEBRA COURSE 1 CONTEST SOLUTIONS

Answers

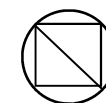
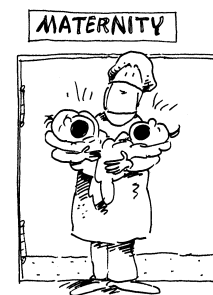
1. If $x = 2013$, then $(x - 2012)^{(x - 2013)} = (2013 - 2012)^{(2013 - 2013)} = 1^0 = 1$. A) 0 B) 1 C) 2 D) 10	1. B
2. If $a = 5$, then $4a^3 - 3a^2 + 2a - 1 = 4(5)^3 - 3(5)^2 + 2(5) - 1 = 500 - 75 + 10 - 1$. A) 39 B) 125 C) 434 D) 586	2. C
3. Fred and Ginger danced for $\frac{2013}{x}$ hours last year. Since 2013 is not divisible by 13, x cannot be 13. A) 3 B) 11 C) 13 D) 61	3. C
4. We may rewrite $x^2 - 4x - 12$ as $(x - 6)(x + 2)$, so $x + 2$ is a factor. A) $x + 2$ B) $x - 2$ C) x D) $x - 8$	4. A
5. $2^{400} + 2^{400} = 2(2^{400}) = (2^1)(2^{400}) = 2^{400+1} = 2^{401}$. A) 2^{401} B) 2^{800} C) 4^{400} D) 4^{800}	5. A
6. If $\frac{p}{q} = \frac{2}{3}$, then $\frac{-p}{-q} = \frac{-2}{-3} = \frac{2}{3}$. A) $-\frac{2}{3}$ B) $\frac{-2}{3}$ C) $\frac{2}{-3}$ D) $\frac{2}{3}$	6. D
7. The number of 5 kg weights and 10 kg weights I have is $4w$ and $2w$, respectively. Hence, $5(4w) + 10(2w) = 200$, so $40w = 200$ and $w = 5$. A) 4 B) 5 C) 10 D) 20	7. B
8. $(3x^3 - 4x^2) + (2x^2 - 3x) - (3x^3 - 4) = 3x^3 - 4x^2 + 2x^2 - 3x - 3x^3 + 4 = -2x^2 - 3x + 4$. A) $2x^2 - 3x - 4$ B) $2x^2 - 3x + 4$ C) $-2x^2 - 3x - 4$ D) $-2x^2 - 3x + 4$	8. D
9. Since $3x + 10 = (3x - 4) + 14$, $3x + 10$ is odd. (Odd # + 14 = odd #.) A) positive B) prime C) odd D) even	9. C
10. Yesterday the phone rang at 4 PM or later 80% of the time it rang, and it rang 50 times before 4 PM. Those 50 rings are 20% of all the rings. Thus, the phone rang 250 times yesterday. A) 200 B) 250 C) 300 D) 400	10. B
11. Let the ages of the 5 trees be $t, t - 2, t - 4, t - 6, t - 8$. Then $t + (t - 2) + (t - 4) + (t - 6) + (t - 8) = 4440$. Thus, $5t - 20 = 4440$, and $t = 892$. A) 884 B) 888 C) 890 D) 892	11. D

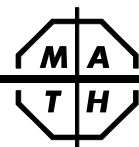


2012-2013 ALGEBRA COURSE 1 CONTEST SOLUTIONS

Answers

12. A line that passes through the points (p, q) and $(2p, 3q)$ has slope $(3q - q)/(2p - p) = 2q/p$. The slope between (p, q) and $(3p, 5q)$ is also $2q/p$. A) $(3p, 4q)$ B) $(3p, 5q)$ C) $(4p, 6q)$ D) $(4p, 8q)$	12. B
13. The multiples of 3 between -9 and 12 include 0, so their product is 0. A) -314928 B) -2916 C) 0 D) 2916	13. C
14. Of children born at the maternity ward yesterday, the ratio of boys to girls was $3x:4y = 5:6$. Thus, $18x = 20y$ or $9x = 10y$. Hence, $x:y = 10:9$. A) 10:9 B) 24:15 C) 15:24 D) 4:5	14. A
15. $\frac{(x^{200})^{400}}{(x^{100})^{200}} = \frac{x^{80000}}{x^{20000}} = x^{60000}$. A) x^4 B) x^6 C) x^{40000} D) x^{60000}	15. D
16. If the average of x, y , and z is 16, their sum is $3(16) = 48$. If the average of x and y is 12, their sum is $2(12) = 24$. Hence $z = 48 - 24 = 24$. A) 4 B) 14 C) 20 D) 24	16. D
17. Both $6n^8$ and $10n^{12}$ are factors of $30n^{12}$, the lcm. A) $2n^8$ B) $30n^{12}$ C) $30n^{24}$ D) $60n^{96}$	17. B
18. If the perim. is 64, each side has length 16. By Pythag. Th., a diameter is $16\sqrt{2}$. The area is $(8\sqrt{2})^2\pi = 128\pi$. A) 16π B) 32π C) 64π D) 128π	18. D
19. Since $(x - y)^2 = 3^2, x^2 + y^2 - 2xy = 9$. Hence $485 - 2xy = 9$, and $xy = 238$. A) 162 B) 238 C) 482 D) 3880	19. B
20. The roots of $(x - 1)(x + 2)(x - 3) \times \dots \times (x - 19)(x + 20)(x - 21) = 0$ are 1, -2, 3, -4, ..., 19, -20, and 21. Their sum is $(1 - 2) + (3 - 4) + \dots + (19 - 20) + 21 = -10 + 21 = 11$. A) 10 B) 11 C) 21 D) 31	20. B
21. $ 4x + 4 -x = 4 x + 4 x = 8 x $. A) 0 B) 8 C) $8 x $ D) $4 4x $	21. C
22. $\sqrt{36^{64}} = \sqrt{(36^{32})(36^{32})} = 36^{32}$. A) 6^8 B) 6^{32} C) 36^8 D) 36^{32}	22. D





2018-2019 Annual Algebra Course 1 Contest

Spring, 2019

Instructions



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23. Don and Juan had a total of x cherries, but then Don ate 27 fewer than x cherries and Juan ate 11 fewer than x cherries. If they each ate at least 10 cherries, and there was at least one cherry that wasn’t eaten, then $x =$ A) 37 B) 38 C) 39 D) 49		23.
24. Of the 200 pets for sale at Pip’s Pets, a have scales, b have gills, and c have both. How many of the pets have neither scales nor gills? A) $200 - a - b$ B) $200 - c$ C) $200 - a - b - c$ D) $200 - a - b + c$		24.
25. The product of two numbers is 144, and the lesser of the two is 6 less than three times the greater. What is the greater of the two numbers? A) 18 B) 8 C) -6 D) -24		25.
26. If x and y are positive numbers and $x + y = 2$, which of the following could be the value of $20x + 50y$? A) 35 B) 65 C) 105 D) 140		26.
27. Iko’s rectangular vegetable garden is $2x$ m wide and $3x$ m long. She wants to plant flowers to form a border of uniform width around the vegetable garden, and measures that the border will cover $14x^2$ m ² . How wide is the border of flowers going to be? A) $0.5x$ m B) x m C) $1.5x$ m D) $2x$ m		27.
28. If $10^{2019} - 2019$ is written as an integer in decimal form, what is the sum of its digits? A) 2019 B) 18160 C) 18161 D) 18169		28.
29. Tom mixes x kg of cake mix that is 10% sugar with y kg of cake mix that is 20% sugar. If the resulting mixture is $z\%$ sugar, then the ratio of x to y is A) $(20 - z):(z - 10)$ B) $(10 - z):(z + 20)$ C) $(z + 10):(20 - z)$ D) $(z + 20):(10 - z)$		29.
30. If x , y and z are prime, what is the product of all whole-number divisors of the product xyz ? A) xyz B) $x^2y^2z^2$ C) $x^3y^3z^3$ D) $x^4y^4z^4$		30.

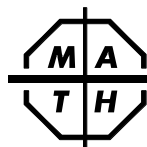
The end of the contest **A**

1. If $a = 2$, $r = 0$, $t = 1$, and $s = 9$, then $s + t + a + r + t =$ A) 0 B) 12 C) 13 D) 21	1.
2. There were a ants in my ant farm, but then 3 ants escaped! If each ant has 6 legs, the ants remaining have a combined total of <u>?</u> legs. A) $6a - 3$ B) $6(a - 3)$ C) $6a - 3a$ D) $a^6 - 3$	2.
3. $6x^2 - 5 + 4x - 3 + 2x^2 - 1 + 2x - 3 + 4x^2 - 5 + 6x =$ A) $36x - 17$ B) $24x - 9$ C) $12x^2 + 12x - 12$ D) $12x^2 + 12x - 17$	3.
4. $(x - y)(x + y) =$ A) $x^2 - y^2$ B) $x^2 - 2xy + y^2$ C) $x^2 + 2xy + y^2$ D) $x^2 + y^2$	4.
5. $(x - y)(x + y)(x - y) =$ A) $x^3 - y^3$ B) $x^3 - x^2y - xy^2 + y^3$ C) $x^3 + y^3$ D) $x^3 + x^2y + xy^2 + y^3$	5.
6. Which of the following is negative for all real values of s ? A) $-s^3 - 1$ B) $(-s)^3 - 1$ C) $-s^2 - 1$ D) $(-s)^2 - 1$	6.
7. $(x^2 - 1)(x^2 - 2)(x^2 - 3)(x^2 - 4) = 0$ has how many integer solutions? A) 2 B) 4 C) 6 D) 8	7.
8. If x , y , and z are distinct prime numbers, which of the following is the least common multiple of $x^2y^3z^4$ and $x^4y^3z^2$? A) $x^8y^9z^8$ B) $x^6y^6z^6$ C) $x^4y^3z^4$ D) $x^2y^3z^2$	8.
9. $((x^3 + x^3) \times x^3)^3 =$ A) $2x^{18}$ B) $8x^{18}$ C) $8x^{27}$ D) x^{54}	9.
10. In my big jar of jellybeans there are exactly $3b$ red beans, $5b$ green beans, and $6b$ orange beans, and no others. There could be a total of <u>?</u> beans. A) 35 B) 42 C) 60 D) 90	10.
11. What is the sum of all solutions to $ 2x - 2.5 = 4$? A) 2 B) 2.5 C) 3.75 D) 4	11.
12. The positive difference between the two roots of $x^2 - 3x - 28 = 0$ is A) 3 B) 4 C) 7 D) 11	12.



13. Today Li turned 42 and Mae turned 8. How old will Mae be when Li is exactly three times Mae's age? A) 9 B) 17 C) 26 D) 51	13.
14. If a crate of lightbulbs contains b boxes, and each box contains p packages, how many bulbs are in 3 crates if each package holds 4 bulbs? A) $12bp$ B) $\frac{3bp}{4}$ C) $\frac{4bp}{3}$ D) $\frac{bp}{12}$	14.
15. Avi and Bea were building sand castles all day. Avi had built three times as many castles as Bea, but then a wave destroyed 3 of Avi's castles while Bea built 1 more. At that point the ratio of Avi's castles to Bea's was 5:2. Avi had built <u>?</u> castles before the wave hit. A) 11 B) 12 C) 30 D) 33	15.
16. If $135 \times 46 = a$, then $135 \times 48 =$ A) $a + 2$ B) $a + 92$ C) $a + 94$ D) $a + 270$	16.
17. If $3x + 8y = 21$ and $8x + 3y = 23$, then $x + y =$ A) 2 B) 4 C) 11 D) 22	17.
18. If the hands on a circular clock start at midnight, what number will the hour hand point to 1000 hours later? A) 2 B) 4 C) 8 D) 12	18.
19. If x is an integer, what is the least possible value of $ 20 - 7x $? A) 1 B) 2 C) 3 D) 6	19.
20. If Sy can shovel snow from half of a driveway in 2 hours, and Ty can shovel snow from one quarter of the driveway in 2 hours, how many <i>minutes</i> would it take them to shovel the whole driveway working together at their respective constant rates? A) 120 B) 160 C) 180 D) 360	20.
21. Of the bottles that Viola collects, 80% are green. Of the green bottles, 30% held perfume and 45% held spices. If the remaining 25 green bottles held pills, How many bottles are in Viola's collection? A) 75 B) 100 C) 120 D) 125	21.
22. If $x \neq 0$ and $2x - \frac{y - 3x^2}{x} = \frac{4}{x}$, then $y =$ A) $4 - x^2$ B) $4 + x^2$ C) $5x^2 - 4$ D) $4 - 5x^2$	22.





Information & Solutions

Spring, 2019




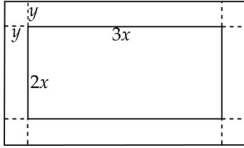

Directions for Grading

- Date** You may give this contest any time after April 15. The *Algebra Course 1 Contest* is for use in your own school or district. We've enclosed a registration form for next year. Instructions for optionally submitting results are included on a separate sheet entitled "Using the Score Report Center."
- Urgent questions?** Write to comments@mathleague.com, or call 1-201-568-6328 or 1-516-365-5656.
- Scores** Remind students that *this is a contest, and not a test*—there is no "passing" or "failing" score. Few students score as high as 24 points (80% correct); students with half that, 12 points, *should be commended!*
- Solutions** Detailed solutions appear in each question box, and letter answers are in the *Answers* columns on the right. You may copy this solution key and give a copy to every student who took this contest.
- Awards** The original contest package contained 1 book award (and a bookplate you should affix to the book's inside front cover) for the 1st place student. We also enclosed 5 *Certificates of Merit*—1 each for the runner-up on each grade level, plus extras for ties.
- Additional Book Awards & Additional Certificates** If you want to give more than 1 book award, you may purchase additional books as described below. Do you need more Certificates of Merit? If so, send your name, school, and school mailing address to our mailer at: **Math Certificates, P.O. Box 17, Tenafly, NJ 07670-0017**. Include a self-addressed, stamped envelope (**2 stamps required**) large enough to hold certificates.

The school's top scorer will receive the book *Math Contests—High School (Vol. 4)*. Other high scorers will receive Certificates of Merit. In any one school year, no student may win both a book and a certificate. The book and certificates were in the original contest package.

If needed, duplicate book awards may be ordered as described below.

Twenty-one books of past contests, *Grades 4, 5, & 6 (Vols. 1, 2, 3, 4, 5, 6, 7)*, *Grades 7 & 8 (Vols. 1, 2, 3, 4, 5, 6, 7)*, and *High School (Vols. 1, 2, 3, 4, 5, 6, 7)*, are available, for \$12.95 per volume, from Math League Press, P.O. Box 17, Tenafly, NJ 07670-0017.

<p>23. Don ate $x - 27$ cherries and Juan ate $x - 11$ cherries. Since $x - 27 \geq 10$ and $x - 11 \geq 10$, $x \geq 37$. In addition, $x - 11 + x - 27 \leq x - 1$, so $x \leq 37$. Therefore, $x = 37$.</p> <p>A) 37 B) 38 C) 39 D) 49</p>	 <p>23. A</p>
<p>24. If we subtract a and b from 200, we subtract the pets with scales and gills twice. Adding them back once, we have $200 - a - b + c$ with neither.</p> <p>A) $200 - a - b$ B) $200 - c$ C) $200 - a - b - c$ D) $200 - a - b + c$</p>	<p>24. D</p>
<p>25. Since $xy = 144$ and $y = 3x - 6$, $3x^2 - 6x = 144$. Hence, $x^2 - 2x - 48 = 0$. Thus, $(x + 6)(x - 8) = 0$ and $x = -6$ or 8. Since $y < x$, $x = -6$.</p> <p>A) 18 B) 8 C) -6 D) -24</p>	<p>25. C</p>
<p>26. If $x + y = 2$, $y = 2 - x$ and $20x + 50y = 20x + 50(2 - x) = 100 - 30x < 100$. Similarly, $x = 2 - y$ and $20x + 50y = 40 + 30y > 40$.</p> <p>A) 35 B) 65 C) 105 D) 140</p>	<p>26. B</p>
<p>27. If the border's width is y, the area of the border is $2y(2x) + 2y(3x) + 4y^2 = 4y^2 + 10xy$. We are given the area is $14x^2$, so $4y^2 + 10xy = 14x^2$. Thus, $(2y + 7x)(y - x) = 0$. Since $y > 0$, $y = x$.</p> <p>A) $0.5x$ m B) x m C) $1.5x$ m D) $2x$ m</p>	 <p>27. B</p>
<p>28. 10^{2019} has 2020 digits. Subtracting 2019 from 10^{2019}, the result is 999 999 999 ... 999 997 981. That's $2015(9)+7+9+8+1 = 18160$.</p> <p>A) 2019 B) 18160 C) 18161 D) 18169</p>	<p>28. B</p>
<p>29. The percent of sugar is $(10x+20y)/(x+y)$. Set this equal to z and solve: $10x+20y = xz+y z$, so $(10 - z)x = (z - 20)y$ and $x/y = (z - 20):(10 - z)$.</p> <p>A) $(20 - z):(z - 10)$ B) $(10 - z):(z + 20)$ C) $(z + 10):(20 - z)$ D) $(z + 20):(10 - z)$</p>	 <p>29. A</p>
<p>30. If x, y, and z are prime, the whole-number divisors of the product xyz are 1, x, y, z, xy, xz, yz, and xyz. The product of these is $x^4y^4z^4$.</p> <p>A) xyz B) $x^2y^2z^2$ C) $x^3y^3z^3$ D) $x^4y^4z^4$</p>	<p>30. D</p>

The end of the contest **A**

2018-2019 ALGEBRA COURSE 1 CONTEST SOLUTIONS

Answers

1. If $a = 2$, $r = 0$, $t = 1$, and $s = 9$, then $s + t + a + r + t = 9 + 1 + 2 + 0 + 1 = 13$.
A) 0 B) 12 C) 13 D) 21
2. There were a ants in my ant farm. They have $6a$ legs. After 3 ants leave, the remaining ants have $6a - 18 = 6(a - 3)$ legs.
A) $6a - 3$ B) $6(a - 3)$ C) $6a - 3a$ D) $a^6 - 3$
3. Regroup: $(6x^2 + 2x^2 + 4x^2) + (4x + 2x + 6x) - (5 + 3 + 1 + 3 + 5)$.
A) $36x - 17$ B) $24x - 9$
C) $12x^2 + 12x - 12$ D) $12x^2 + 12x - 17$
4. $(x - y)(x + y) = x^2 + xy - xy - y^2 = x^2 - y^2$.
A) $x^2 - y^2$ B) $x^2 - 2xy + y^2$ C) $x^2 + 2xy + y^2$ D) $x^2 + y^2$
5. $(x - y)(x + y)(x - y) = (x^2 - y^2)(x - y) = x^3 - x^2y - xy^2 + y^3$.
A) $x^3 - y^3$ B) $x^3 - x^2y - xy^2 + y^3$
C) $x^3 + y^3$ D) $x^3 + x^2y + xy^2 + y^3$
6. Since $-s^2 \leq 0$ for all real values of s , $-s^2 - 1 < 0$ for all real values of s .
A) $-s^3 - 1$ B) $(-s)^3 - 1$ C) $-s^2 - 1$ D) $(-s)^2 - 1$
7. The integer solutions of $(x^2 - 1)(x^2 - 2)(x^2 - 3)(x^2 - 4) = 0$ are $\pm 1, \pm 2$.
A) 2 B) 4 C) 6 D) 8
8. If x , y , and z are distinct prime numbers, the least common multiple of $x^2y^3z^4$ and $x^4y^3z^2$ must contain the highest power of each prime.
A) $x^8y^9z^8$ B) $x^6y^6z^6$ C) $x^4y^3z^4$ D) $x^2y^3z^2$
9. $((x^3 + x^3) \times x^3)^3 = (2x^3 \times x^3)^3 = (2x^6)^3 = 2^3x^{18} = 8x^{18}$.
A) $2x^{18}$ B) $8x^{18}$ C) $8x^{27}$ D) x^{54}
10. In my jar, there are $3b$ red beans, $5b$ green beans, $6b$ orange beans, for a total of $14b$ beans. If $b = 3$, the total number of beans would be 42.
A) 35 B) 42 C) 60 D) 90
11. $2x - 2.5 = \pm 4$, so $x = 3.25$ or -0.75 . The sum of the solutions is 2.5.
A) 2 B) 2.5 C) 3.75 D) 4
12. The roots of $(x - 7)(x + 4) = 0$ are 7 and -4 . Their difference is 11.
A) 3 B) 4 C) 7 D) 11



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Answers

13. Today Li turned 42 and Mae turned 8. In x years, we want $42 + x = 3(8 + x)$. Solving, $x = 9$. Therefore, Mae will be 17.
A) 9 B) 17 C) 26 D) 51
14. Three crates contain $3b$ boxes, and three boxes contain $3bp$ packages. If each package holds 4 bulbs, three crates contain $12bp$ bulbs.
A) $12bp$ B) $\frac{3bp}{4}$ C) $\frac{4bp}{3}$ D) $\frac{bp}{12}$
15. Before the wave hit, $a = 3b$. After the wave hit, $(a - 3)/(b + 1) = 5/2$. Combining these equations, $(3b - 3)/(b + 1) = 5/2$. Simplifying, $6b - 6 = 5b + 5$. Solving, $b = 11$. Since $a = 3b$, $a = 33$. Thus, Avi had built 33 sand castles before the wave hit.
A) 11 B) 12 C) 30 D) 33
16. If $135 \times (46 + 2) = (135 \times 46) + 270 = a + 270$.
A) $a + 2$ B) $a + 92$ C) $a + 94$ D) $a + 270$
17. If $3x + 8y = 21$ and $8x + 3y = 23$, $11x + 11y = 44$ and $x + y = 4$.
A) 2 B) 4 C) 11 D) 22
18. If the hands on a circular clock start at midnight, 1000 hours later is 83 full times around and then one-third more, which is 4 hours.
A) 2 B) 4 C) 8 D) 12
19. If $x = 3$, the value of $|20 - 7x|$ is 1.
A) 1 B) 2 C) 3 D) 6
20. If Sy can shovel snow from half of a driveway in 2 hours, and Ty can shovel snow from one quarter of the driveway in 2 hours, together they shovel three-quarters of the driveway in 120 minutes or one quarter in 40 minutes or four-quarters in 160 minutes.
A) 120 B) 160 C) 180 D) 360
21. Of the bottles that Viola collects, 80% are green. Of the green bottles, 30% held perfume 45% held spices. Thus, 25% of the green bottles held pills. Since 25% of 80% is 20%, and 20% of her bottles is 25, 100% of her bottles is 125.
A) 75 B) 100 C) 120 D) 125
22. Clearing fractions, $2x^2 - y + 3x^2 = 4$; $y = 5x^2 - 4$.
A) $4 - x^2$ B) $4 + x^2$ C) $5x^2 - 4$ D) $4 - 5x^2$

