Pre-Calculus

placement test

Welcome!

Thank you for your interest in Thinkwell. We know the curriculum selection process for your homeschool student can be challenging. This Placement Test was created to provide you with a tool to place your student in the appropriate level of math.

Please keep in mind, no placement test is perfect. If you have questions or concerns about the results of your student's placement test, reach out to us at Thinkwell support: support@thinkwell.com.

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Instructions and Overview

This placement test consists of 20 free-response questions. There is no time-limit for the test, but it shouldn't take your student longer than an hour to an hour and a half to complete. Your student should work each problem to the best of their ability. If they are unable to answer an item, tell them to move on to the next item and leave the question unanswered.

The Precalculus placement test will assess your student's aptitude for the following skill areas:

- o   Simplifying powers and radicals.
- o   Rationalizing the denominator of expressions.
- o   Solving linear, quadratic, polynomial, and logarithmic equations
- o   Solving nonlinear systems of equations.
- o   Factoring polynomials.
- o   Simplifying rational expressions.
- o   Solving absolute-value equations and inequalities.
- o   Writing the equation of linear and quadratic functions.
- o   Performing composition of functions.
- o   Using the Law of Sines and Law of Cosines.

We recommend you **print the question portion of this document (pages 4–6)** so your student can work out the problems with pencil and paper.

Please be aware that **the answer key for this test starts on page 8**. We advise you to share the answer key with your student only after they've completed the test in its entirety.

Video solutions for all the question items on this test are available by clicking the solution link in the answer key.

Questions? Concerns? Please reach out to us at support@thinkwell.com.

Thinkwell Placement Test: Precalculus

1. Simplify.
   $(5^2 m^5 p^4)(5mp^6 q^2)$

2. Rationalize the denominator. Write the answer in simplest radical form.
   $$\frac{3}{\sqrt{2}+1}$$

3. Simplify.
   $(3x)^{-\frac{1}{2}}$

4. Solve the system of equations.
   $$\begin{cases} y = x^2 - x - 1 \\ 3x - y = 4 \end{cases}$$

5. Factor the polynomial.
   $4x^3 y^3 + 8x^4 y^3 - 12x^2 y^4$

6. Determine whether the trinomial is a perfect square. If so, factor. If not, explain.
   $9y^2 - 6y + 1$

7. Find the domain of the expression.
   $$\frac{3x-1}{x^2+2x-3}$$

8. Divide. Write the answer in simplest form.
   $$\frac{x^2+x}{5} \div \frac{xy+y}{25}$$

9. Divide. Write the answer in simplest form.
   $$\frac{2-\dfrac{2}{t}}{2+\dfrac{2}{t}}$$

10. Solve.

$$\frac{3x}{x+4} = 2 - \frac{12}{x+4}$$

11. Solve.

$$3x^2 - 5x + 3 = 0$$

12. Solve the polynomial equation by factoring.

$$5x^4 + 10x^3 + 5x^2 = 0$$

13. Solve.

$$|3x - 1| = 2$$

14. Solve.

$$|6x + 4| < 1$$

15. Solve. Express the solution in interval notation.

$$0 \le 2x + 6 < 18$$

16. Solve.

$$\log(5x - 1) = 2 + \log(x - 2)$$

17. Find the equation of the line that passes through $(1, 2)$ and is perpendicular to $x + y = 4$.

18. Given $f(x) = 3x - 1$ and $g(x) = 2x^2 + x + 1$, perform the given composition.
    $(f \circ g)(3)$

19. Write the general form equation of the parabola that passes through $(-3, -4)$ with vertex $(6, 5)$.

20. The pole that supports a beach volleyball net is 2.25 meters tall and makes a 91° angle with the ground. To stabilize the net, a rope is attached to the top of the pole and extends to the ground 1.75 meters from the base of the pole. How long is the rope, and what angle does it make with the ground? Round the length to the nearest tenth and the angle measure to the nearest degree.

Scoring Guide

Use the scoring rubric below to help determine if Precalculus is the appropriate course for your student.

Your placement test score and corresponding course recommendation should not be the only determining factor when deciding the appropriate course for your student. Your student's grade-level experience in previously completed math courses should also be considered.

Please feel free to contact a Thinkwell representative at support@thinkwell.com if you'd like to discuss your student's course placement in greater detail.

Number of questions correct	Course recommendation
7 or less	Algebra 2
8 – 20	Precalculus
20 or more	Trigonometry

See the Answer Key page for answers and explanations for all placement test questions.

Wondering about the difference between Precalculus and Trigonometry?
Here's a brief overview:

Precalculus vs. Trigonometry:

Thinkwell's Precalculus includes advanced algebra and trigonometry topics which will prepare students for the study of Calculus. Both Precalculus and Trigonometry include topics first introduced in Algebra 2, such as graphing quadratic and exponential functions; however additional Algebra 2 topics, such as solving systems of equations, are covered in Precalculus, but not in Trigonometry. All topics in Trigonometry are included in the Precalculus course.

In brief:

Precalculus (356 Videos)	Trigonometry (195 videos)
1 Basic Algebra Review	1 Algebraic Prerequisites
2 Equations and Inequalities	2 The Trigonometric Functions
3 Relations and Functions	3 Trigonometric Identities
4 Polynomial and Rational Functions	4 Applications of Trigonometry
5 Exponential and Logarithmic Functions	5 Complex Numbers and Polar Coordinates
6 The Trigonometric Functions	6 Exponential and Logarithmic Functions
7 Trigonometric Identities	7 Conic Sections
8 Applications of Trigonometry	
9 Systems of Equations and Matrices	
10 Special Topics	

answer key

1. Simplify.
$(5^2 m^5 p^4)(5mp^6 q^2)$

Answer: $125m^6 p^{10} q^2$

View Video Explanation: Product of Powers Property

2. Rationalize the denominator. Write the answer in simplest radical form.
$$\frac{3}{\sqrt{2}+1}$$

Answer: $3\sqrt{2} - 3$ (or $3(\sqrt{2}-1)$)

View Video Explanation: Rationalizing a Denominator

3. Simplify.
$(3x)^{-\frac{1}{2}}$

Answer: $\dfrac{1}{\sqrt{3x}}$

View Video Explanation: Converting Rational Exponents and Radicals

4. Solve the system of equations.
$$\begin{cases} y = x^2 - x - 1 \\ 3x - y = 4 \end{cases}$$

Answer: (1, −1) and (3, 5)

View Video Explanation: Solving Nonlinear Systems and Radicals

5. Factor the polynomial.
$4x^3 y^3 + 8x^4 y^3 - 12x^2 y^4$

Answer: $4x^2 y^3 (x + 2x^2 - 3y)$

View Video Explanation: Factoring Using the Greatest Common Factor

6. Determine whether the trinomial is a perfect square. If so, factor. If not, explain.
$9y^2 - 6y + 1$

Answer: It is a perfect square. $(3y - 1)^2$

View Video Explanation: Factoring Perfect-Square Trinomials

7. Find the domain of the expression.
$$\frac{3x - 1}{x^2 + 2x - 3}$$

Answer: $x \neq -3, 1$

View Video Explanation: Rational Expressions and Domain

8. Divide. Write the answer in simplest form.
$$\frac{x^2 + x}{5} \div \frac{xy + y}{25}$$

Answer: $\dfrac{5x}{y}$

View Video Explanation: Multiplying and Dividing Rational Expressions

9. Divide. Write the answer in simplest form.
$$\frac{2 - \dfrac{2}{t}}{2 + \dfrac{2}{t}}$$

Answer: $\dfrac{t - 1}{t + 1}$

View Video Explanation: Rewriting Complex Fractions

10. Solve.
$$\frac{3x}{x + 4} = 2 - \frac{12}{x + 4}$$

Answer: No solution

View Video Explanation: Solving a Linear Equation with Rationals

11. Solve.
$3x^2 - 5x + 3 = 0$

Answer: $x = \dfrac{5 + \sqrt{11}i}{6}$; $x = \dfrac{5 - \sqrt{11}i}{6}$

View Video Explanation: Using the Quadratic Formula

12. Solve the polynomial equation by factoring.
$5x^4 + 10x^3 + 5x^2 = 0$

Answer: $x = 0$; $x = -1$

View Video Explanation: Solving a Polynomial Equation by Factoring

13. Solve.
$|3x - 1| = 2$

Answer: $x = 1$; $x = -\dfrac{1}{3}$

View Video Explanation: Solving Absolute Value Equations

14. Solve.
$|6x + 4| < 1$

Answer: $-\dfrac{5}{6} < x < -\dfrac{1}{2}$

View Video Explanation: Solving Absolute Value Inequalities

15. Solve the inequality. Express the solution in interval notation.
$0 \le 2x + 6 < 18$

Answer: [−3, 6)

View Video Explanation: Solving Compound Inequalities

16. Solve.
$\log(5x - 1) = 2 + \log(x - 2)$

Answer: $x = \dfrac{199}{95}$

View Video Explanation: Solving Logarithmic Equations

17. Find the equation of the line that passes through (1, 2) and is perpendicular to $x + y = 4$.

Answer: $y = x + 1$

View Video Explanation: Equations of Parallel and Perpendicular Lines

18. Given $f(x) = 3x - 1$ and $g(x) = 2x^2 + x + 1$, perform the given composition.
$(f \circ g)(3)$

Answer: 65

View Video Explanation: Composition of Functions

19. Write the general form equation of the parabola that passes through (−3, −4) with vertex (−6, 5).

Answer: $f(x) = -x^2 - 12x - 31$

View Video Explanation: Writing the Equation of a Quadratic Function

20. The pole that supports a beach volleyball net is 2.25 meters tall and makes a 91° angle with the ground. To stabilize the net, a rope is attached to the top of the pole and extends to the ground 1.75 meters from the base of the pole. How long is the rope, and what angle does it make with the ground? Round the length to the nearest tenth and the angle measure to the nearest degree.

Answer: Rope is 2.9 m, angle is 51°

View Video Explanation: Law of Sines and Law of Cosines

About Thinkwell Courses

Thinkwell offers the following core courses in our Homeschool Math series:

- o 6th Grade Math
- o 7th Grade Math
- o 8th Grade Math
- o Algebra 1
- o Geometry
- o Algebra 2
- o Precalculus
- o Trigonometry
- o Calculus

- o Honors 6th Grade Math
- o Honors 7th Grade Math
- o Honors 8th Grade Math
- o Honors Algebra 1
- o Honors Geometry
- o Honors Algebra 2
- o AP Calculus AB
- o AP Calculus BC

What's the difference between the standard Thinkwell courses and the honors courses?

In general, the Thinkwell Honors courses will be faster-paced and more rigorous than our standard courses. Our Honors courses will cover more material than the standard courses and the assessments will be more challenging. Unless you need the Honors recognition for your student's transcript, or unless your student is aiming to pursue a science or math-related course of study, we recommend sticking with the standard course sequence.

Typical Sequence of Secondary Math Courses

A typical sequence of secondary math courses completed by a college-bound student is listed below. Most college-bound students will take seven or eight years of math between 6th and 12th grades, beginning with 6th Grade Math and ending with Precalculus or Calculus.

Standard Sequence:
<u>Middle school:</u>

Year 1	Year 2	Year 3
6th Grade Math	7th Grade Math	8th Grade Math (Prealgebra)

<u>High School:</u>

Year 1	Year 2	Year 3	Year 4
Algebra 1	Geometry	Algebra 2	Precal or Trig

Accelerated Sequence:
<u>Middle school:</u>

Year 1	Year 2	Year 3
7th Grade Math	8th Grade Math (Prealgebra)	Algebra 1

<u>High School:</u>

Year 1	Year 2	Year 3	Year 4
Geometry	Algebra 2	Precal or Trig	Calculus

Where Do You Begin?

If you wondering about where to start your student with the Thinkwell math course sequence, we recommend that you **begin with the end in mind**.

In other words, where do you want your student to be at the end of their course of study in high school? If your student is college-bound, and you want them to take Calculus before they go to college, then work backwards from the 'accelerated sequence' above to see where you need to be right now.

Unless your student is planning to pursue a science or math-related degree, Calculus doesn't necessarily need to be the terminal course for your high school student.

Questions? Please reach out to us at <u>support@thinkwell.com</u>. We're here and happy to help.