8 Graphs of Linear and Quadratic Functions

Basic Practice

1. A variable y is a function of another variable x if each value of x corresponds to exactly one value of y.

Table 1

x	0	1	2	3
y	2	4	6	8

Table 2

x	0	1	2	3
y	0	2	2	0

Table 3

x	0	1	4	9
y	0	±1	±2	±3

Table 4

x	0	1	2	3
y	5	5	5	5

(a) Which one of the above table of values does not represent a function?
(b) Explain your answer.

2. A variable y is a function of another variable x if each value of x corresponds to exactly one value of y.

Graph A

Graph B
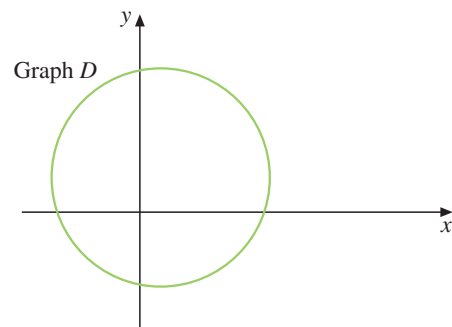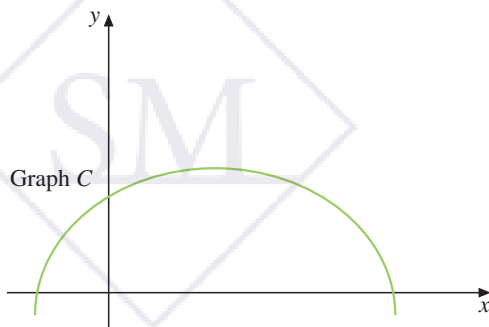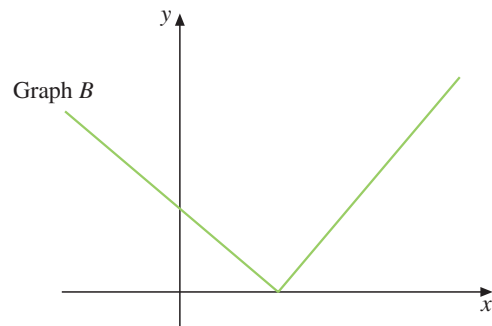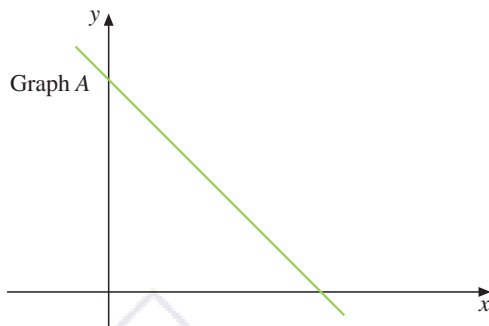
Graph C

Graph D

(a) Which one of the above graphs does not represent a function?
(b) Explain your answer.

21. Suppose that it takes 5 minutes for a candle of length 8 cm to burn 1 cm. Let y cm be the length of the candle after x minutes.

(a) Copy and complete the following table.

x	0	10	20	30	40
y					

(b) Taking 4 cm to represent 10 units on the x-axis and 2 cm to represent 1 unit on the y-axis, draw the graph of y against x for $0 \leqslant x \leqslant 40$.

(c) Use the graph in (b) to estimate

    (i) the length of the candle that has been burnt after $17\frac{1}{2}$ minutes,

    (ii) the time taken for 5 cm of the candle to burn.

(d) (i) Write down the y-intercept of the graph.

    (ii) Find the slope of the graph.

    (iii) Hence, express y as a function of x.

22. An open rectangular container of depth 10 cm is 20% filled with water initially.
Water is dripped into the container so that the water level in it increases at a constant rate of 0.5 cm every 30 seconds.
Let y cm be the depth of water in the container after x minutes.

(a) Copy and complete the following table.

x	0	2	4	6	8
y					

(b) Taking 2 cm to represent 1 unit on the x-axis and 1 cm to represent 1 unit on the y-axis, draw the graph of y against x for $0 \leqslant x \leqslant 8$.

(c) Use the graph in (b) to estimate

    (i) the depth of the water after 7 minutes,

    (ii) the time taken to fill the container to a depth of 5 cm.

(d) (i) Write down the y-intercept of the graph.

    (ii) Find the slope of the graph.

    (iii) Hence, express y as a function of x.

23. The altitude y metres of a mini aircraft above ground level at time t seconds is given by $y = t^2 - 7t + 50$ for $0 \leqslant t \leqslant 7$. The following table shows some corresponding values of t and y.

t	0	1	2	3	4	5	6	7
y	50	p	40	38	q	40	44	50

(a) Calculate the values of p and q.

(b) Taking 2 cm to represent 1 unit on the t-axis and 2 cm to represent 5 units on the y-axis, draw the graph of $y = t^2 - 7t + 50$ for $0 \leqslant t \leqslant 7$.
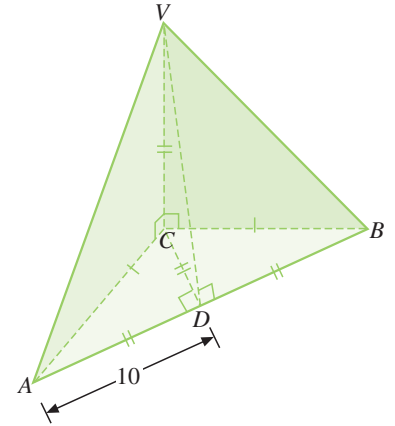
(c) Estimate from the graph, the minimum altitude of the mini aircraft during its flight. Write down the corresponding time.

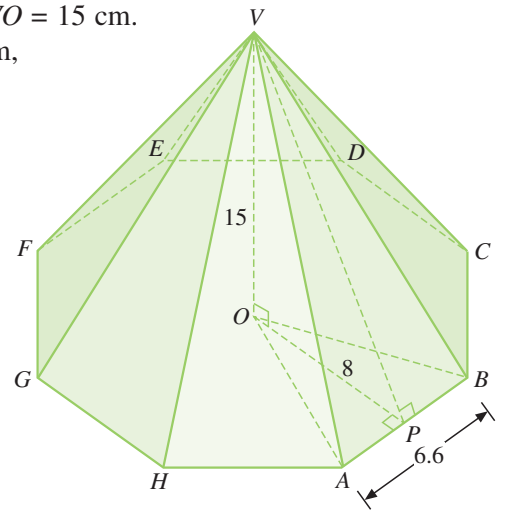(d) Estimate from the graph, the time interval for which the mini aircraft is at most 45 cm above ground level.

14. Calculate the total surface area of each of the following pyramids.
   (a) $BC = AC$ and $AD = BD = CD = VC = 10$ cm.
   $m\angle ADC = m\angle ACV = m\angle BDV = m\angle BCV = 90°$.

   (b) *VABCDEFGH* is a right octagonal pyramid with height $VO = 15$ cm.
   The base *ABCDEFGH* is a regular octagon of side 6.6 cm,
 $OP = 8$ cm, and $m\angle VOP = m\angle VPB = m\angle OPA = 90°$.

**15.** Suppose that *ABCD* is the base of a solid right square pyramid and $AB = (x - 1)$ cm.
   (a) Find the value of x if the area of *ABCD* is 144 cm².
   (b) Find the height of the pyramid if its volume is 240 cm³.
   (c) Calculate the total surface area of the pyramid.

16. In the figure, *VAB* is a lateral face of a right pyramid and *OV* is the
   height of the pyramid. The base of the pyramid is a regular
   polygon and *AB* is a side of the base. $m\angle AOB = 40°$, $OA = 25$ cm,
   $AB = 17.1$ cm, and $OV = 18$ cm.
   (a) How many lateral faces does the pyramid have?
   (b) **(i)** Calculate the area of $\triangle OAB$.
      (ii) Hence, find the base area of the pyramid.
   (c) **(i)** Calculate the area of $\triangle VAB$.
      (ii) Hence, find the total surface area of all the lateral faces.
   (d) Calculate the volume of the pyramid.
   Give your answer correct to the nearest cm³.
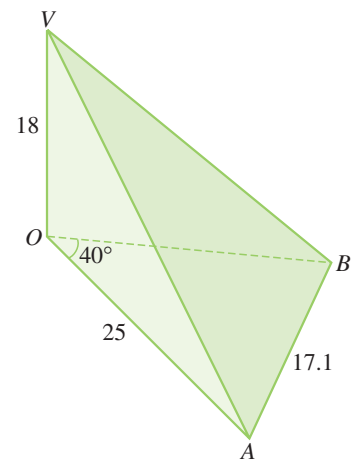
31. Two twin brothers, Rick and Roy, chart their performance in the school Mathematics assessment for the first semester as shown in the following line graphs.

Math results of Rick
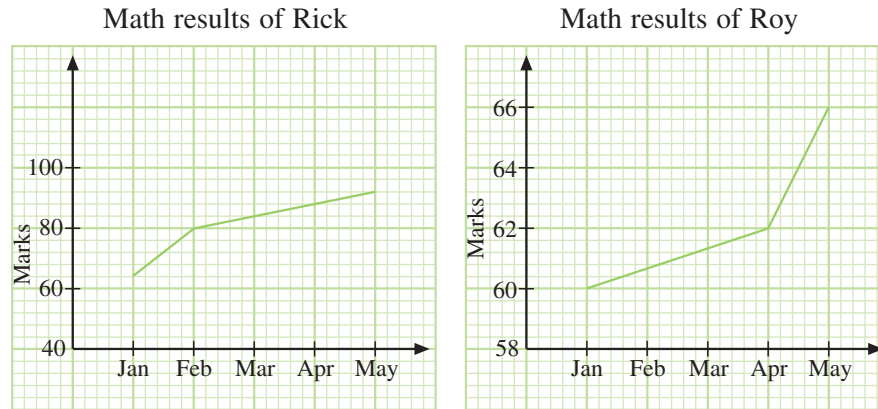
Math results of Roy

(a) Find the percentage improvement in the Math results from January to May of
   (i) Rick,
   (ii) Roy.
(b) By what percentage is the height of the point representing the mark in May higher than that in January on
   (i) Rick's graph,
   (ii) Roy's graph.
(c) With a quick glance of the two graphs, the twin's father commented that Roy has done better than Rick. In what ways have the graphs given the wrong impression to the twin's father?

32. The bar chart below shows the revenue of a company in its first four years of operation.

Revenue of company
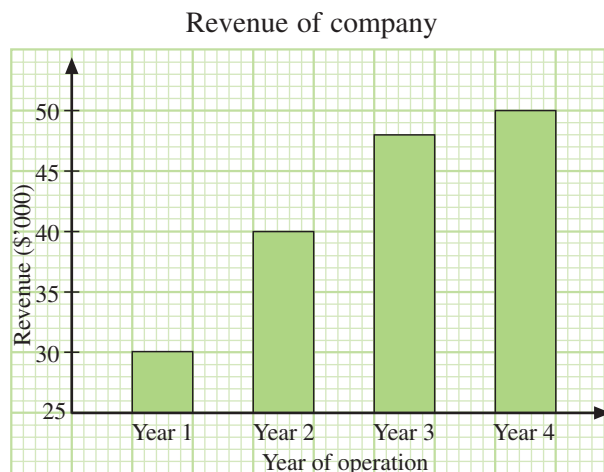
(a) Find the ratio of height of the bar representing the revenue in Year 3 to that in Year 1.
(b) Find the ratio of the revenue in Year 3 to revenue in Year 1.
(c) In what way does this bar graph mislead the readers?
(d) The following table shows the expenditure of the same company in its first four years of operation.

Year of operation	Year 1	Year 2	Year 3	Year 4
Expenditure ($'000)	42	40	36	24

Using a suitable scale, represent accurately both the revenue and expenditure of the company in its first four years of operation in a **single** bar graph.
(e) Describe the company's performance over the four years.