

1(a). A straight line has equation $y = 5x + 11$.

Write down the gradient of the line.

..... [1]

(b). Alex says the graph of $y = 5x + 11$ passes through the point (3, 23).

Is Alex correct?
Show how you decide.

because

.....
..... [2]

2. The expected value of a painting, £ P , is given by the formula

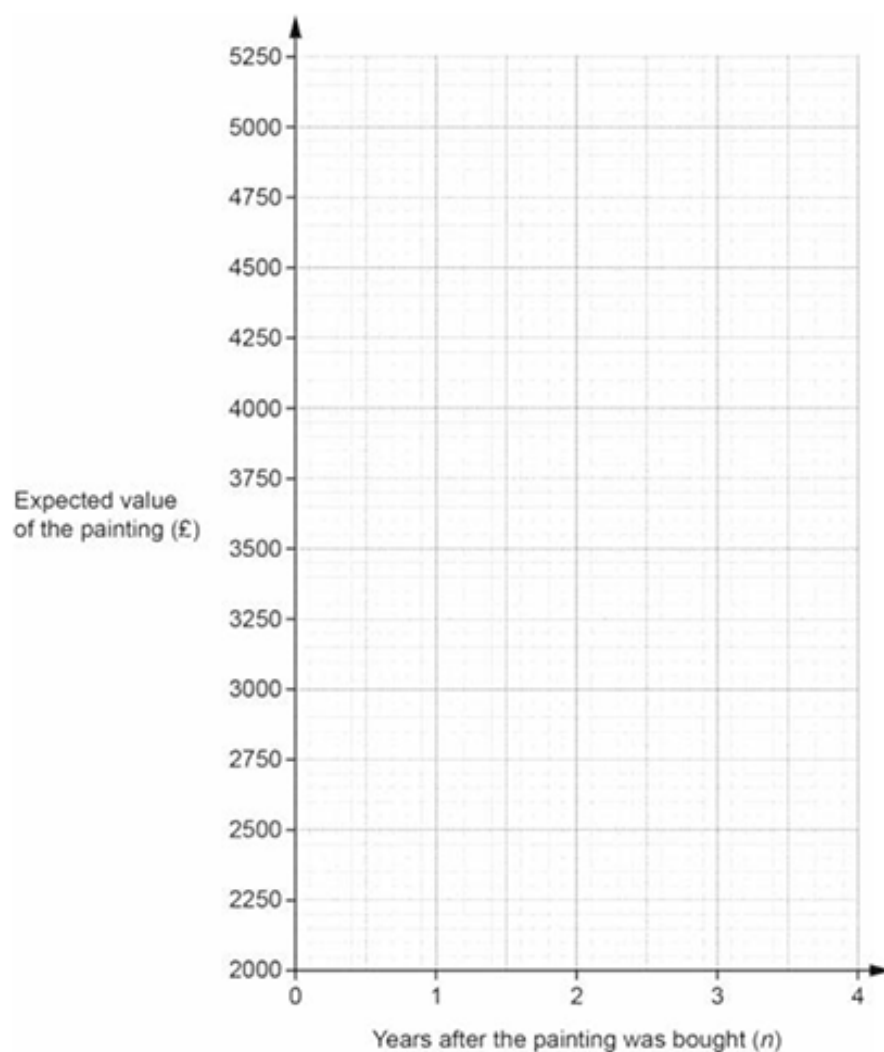
$$P = 3000 \times 1.15^n$$

where n is the number of years after it was bought and $0 \leq n \leq 4$.

The table shows the expected value of the painting n years after it was bought.

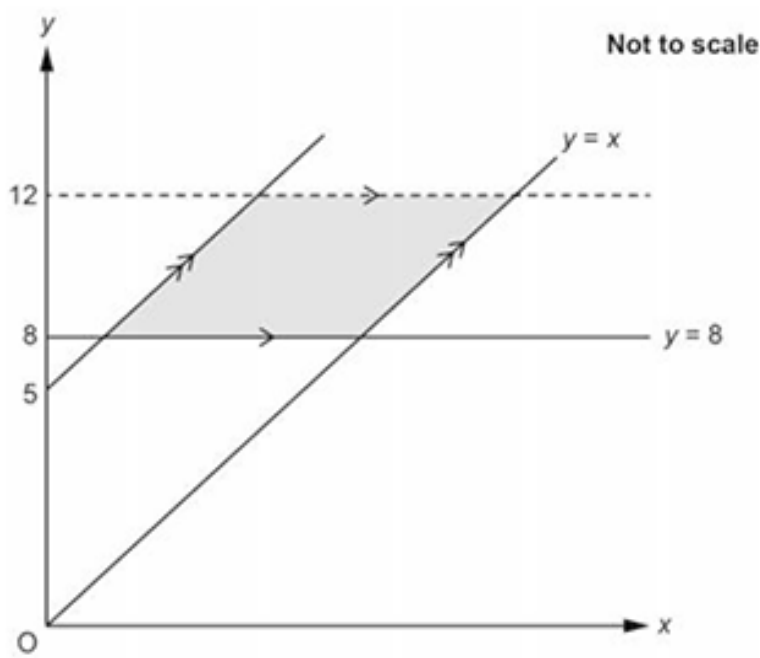
Years after the painting is bought (n)	1	2	3	4
Expected value of the painting, rounded to the nearest £	3450	3968	4563	5247

Draw a suitable graph to show the expected value of the painting n years after it was bought, where $0 \leq n \leq 4$.



[3]

3(a). In the diagram below, the shaded region is a parallelogram. The parallelogram can be identified by four inequalities. Two of the inequalities are $y \geq 8$ and $y \geq x$.



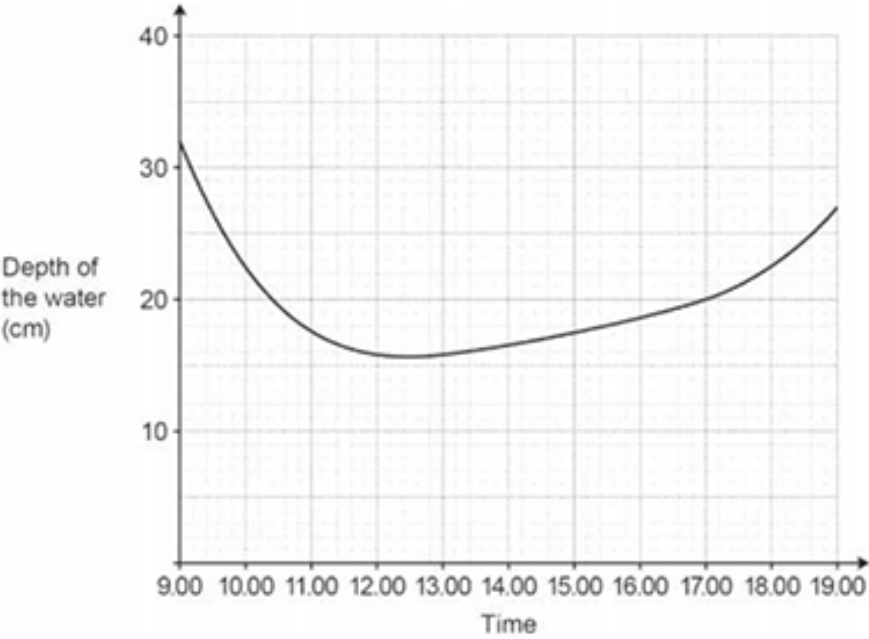
Write down the other **two** inequalities that identify the parallelogram.

.....
.....**[3]**

(b). Work out the area of the parallelogram. You must show your working.

..... square units **[4]**

4(a). This graph shows the depth of the water, in centimetres, at a particular point in a river over a period of 10 hours



Work out the average rate of change in the depth of the water between 9.00 and 17.00.

..... cm per hour **[2]**

(b). Use the graph to estimate the rate of change in the depth of the water at 13.00. You must show working to support your estimate.

..... cm per hour **[4]**

5(a). For each graph below, select its possible equation from this list.

$y = \sqrt{x-4}$

$y = 4^x$

$y = x^4$

$y = \frac{4}{x}$

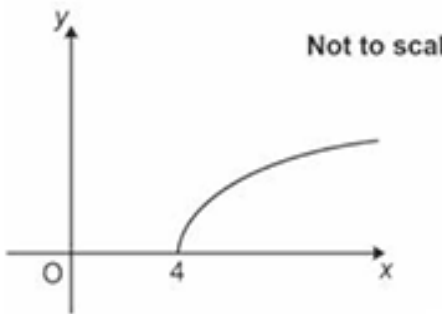
$y = \left(\frac{1}{4}\right)^x$

$y = -4x^2$

$y = 4 \cos x$

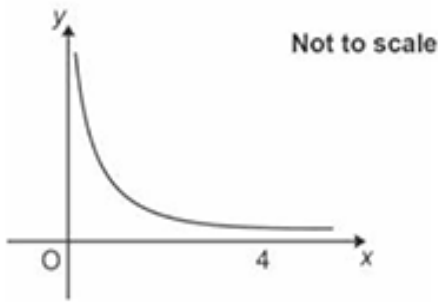
$y = \sqrt{4^2 - x^2}$

i.



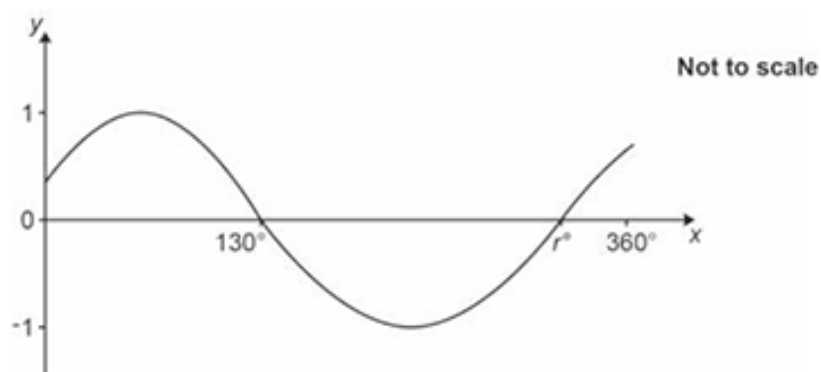
.....[1]

ii.



.....[1]

(b). A graph is drawn on the axes below.



The equation of the graph is $y = \cos(x - p)$, where $0^\circ \leq x \leq 360^\circ$.
The x -intercepts are 130° and r° .

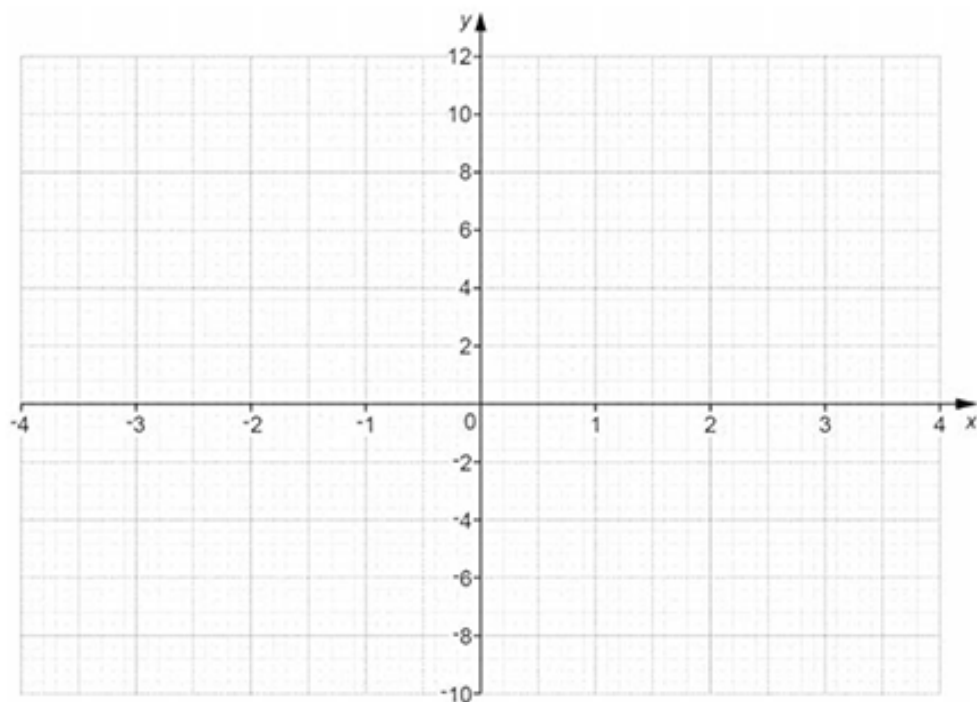
Write down the value of p and the value of r .

$p = \dots\dots\dots$
 $r = \dots\dots\dots$ **[2]**

6(a). Here is a table of values for $y = x^2 - x - 6$.

x	-3	-2	-1	0	1	2	3
y	6	0	-4	-6	-6	-4	0

Draw the graph of $y = x^2 - x - 6$ for $-3 \leq x \leq 3$.



[3]

(b). Write down the equation of the line of symmetry of the graph.

..... [1]

(c). Use the graph to solve the equation $x^2 - x - 6 = 0$.

$x =$ or $x =$ [2]

7.

i. Write down the coordinates of the turning point of the graph $y = (x - 2)^2 + 7$.

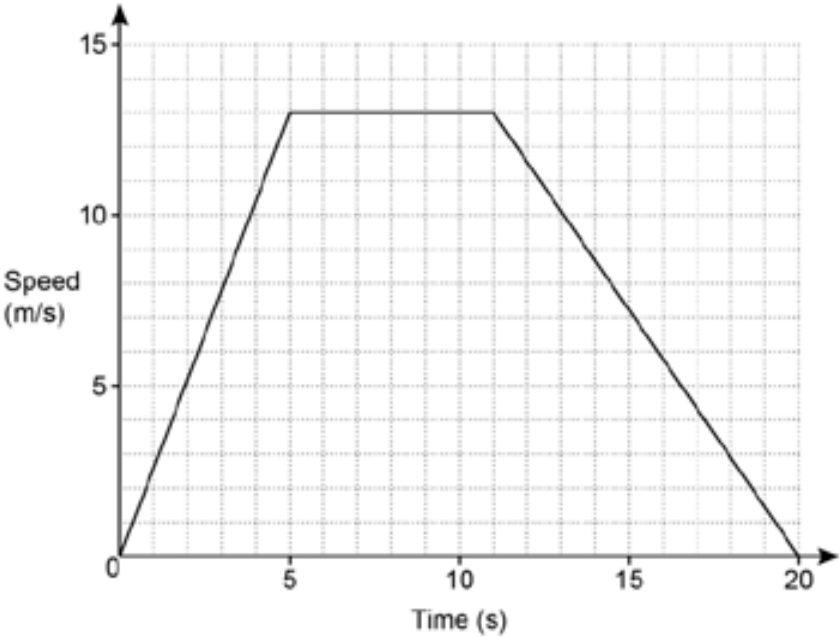
(..... ,) [2]

ii. Describe the **single** transformation which maps the graph of $y = x^2$ onto the graph of $y = (x - 2)^2 + 7$.

..... [2]

8(a).

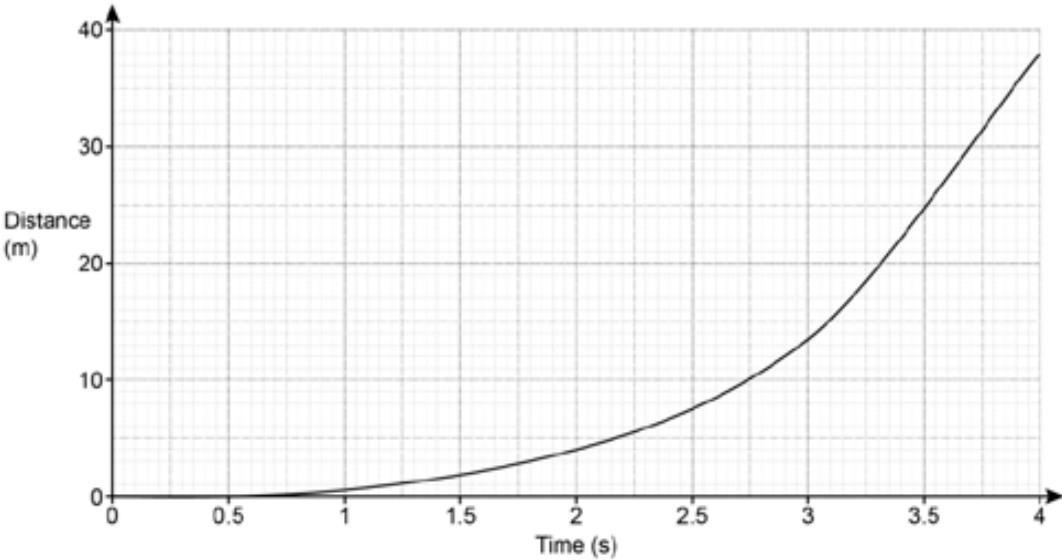
The graph shows the speed of an object during the first 20 seconds of its motion.



Calculate the distance travelled by the object during the 20 seconds.

.....m [3]

(b). The graph shows the distance travelled by an object during the first 4 seconds of its motion.



i. Work out the average speed of this object between 2 and 4 seconds.

..... m/s [2]

ii. Use the graph to estimate the speed of this object at 3 seconds.
You must show working to support your estimate.

..... m/s [3]

- iii. What happens to the speed of this object during these 4 seconds of motion.
Explain how you know.

The speed

I know this because

[1]

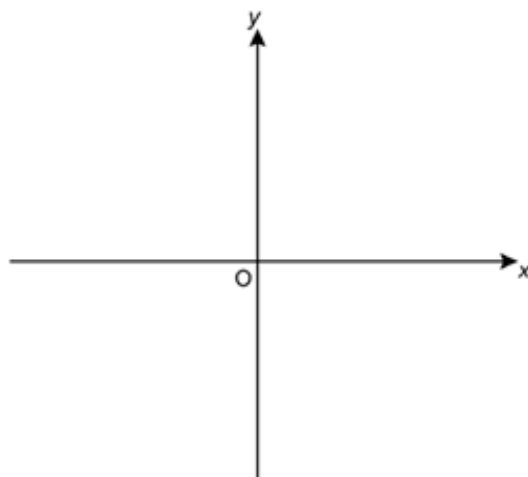
9(a).

Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$.
Indicate any values where the graph crosses the x -axis.



[2]

(b). Sketch the graph of $y = 5^x$.
Indicate any values where the graph crosses the axes.

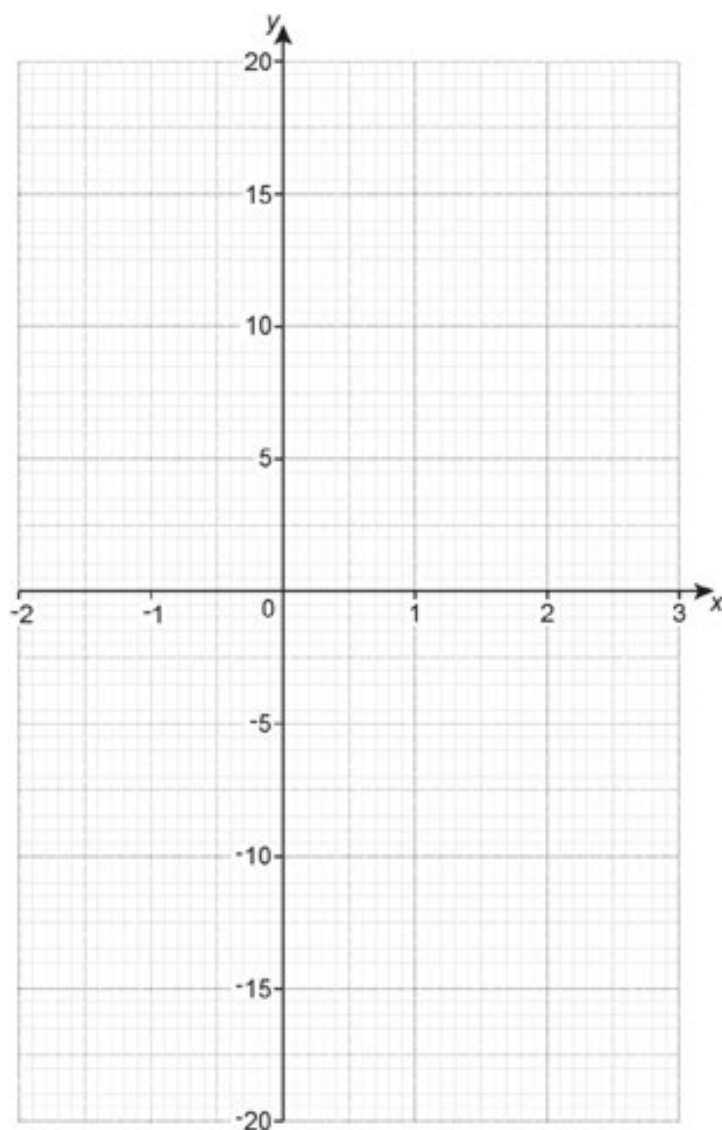


[2]

10(a).Complete this table for $y = x^3 - 2x^2$.

x	-2	-1	0	1	2	3
y	-16		0	-1	0	

[2]

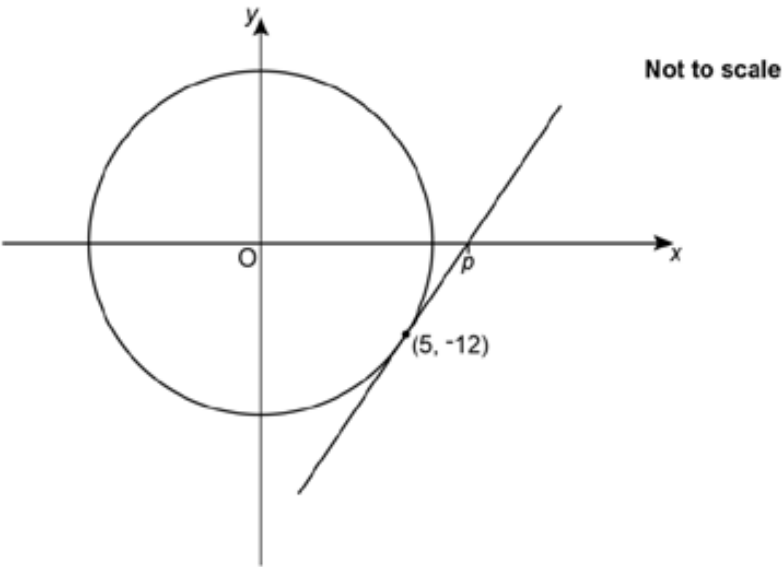
(b). Draw the graph of $y = x^3 - 2x^2$ for values of x from -2 to 3.

[3]

(c). Use the graph to solve the equation $x^3 - 2x^2 = 3$.
Give your answer to **1** decimal place.

..... [1]

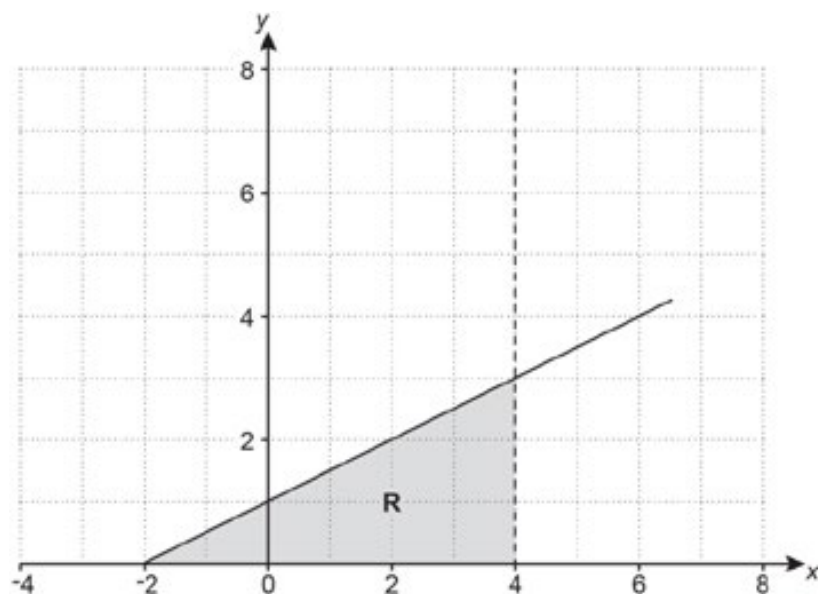
11. The diagram shows a circle with centre $(0, 0)$ and a tangent at $(5, -12)$.
The tangent at $(5, -12)$ crosses the x -axis at $(p, 0)$.



Find the exact value of p .
You must show your working.

$p =$ [5]

12. The region **R** is shown on this grid.



The region **R** is defined by three inequalities.
The first inequality is given below.

Complete the second inequality and write down the third inequality needed to define region **R**.

$$y \geq 0$$

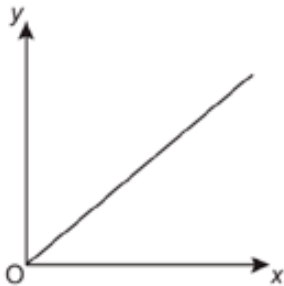
$$2y \dots\dots\dots x + 2$$

.....

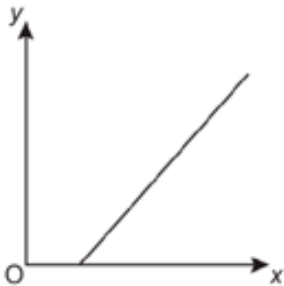
[3]

13. Below are six graphs, numbered 1 to 6, that show different relationships between x and y .

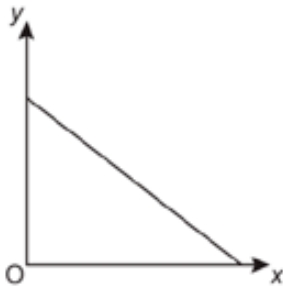
Graph 1



Graph 2



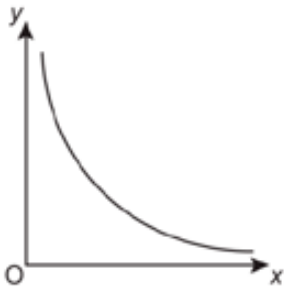
Graph 3



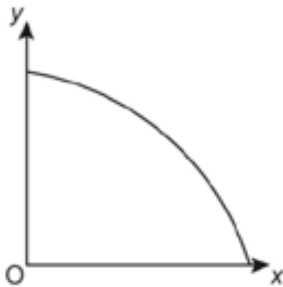
Graph 4



Graph 5



Graph 6



For each description below, write down the number of the graph that best represents the relationship between x and y .

x : temperature in $^{\circ}\text{F}$

y : temperature in $^{\circ}\text{C}$, where $y = \frac{5}{9}(x - 32)$

Graph

x : time taken to run 100 m

y : average speed when running 100 m

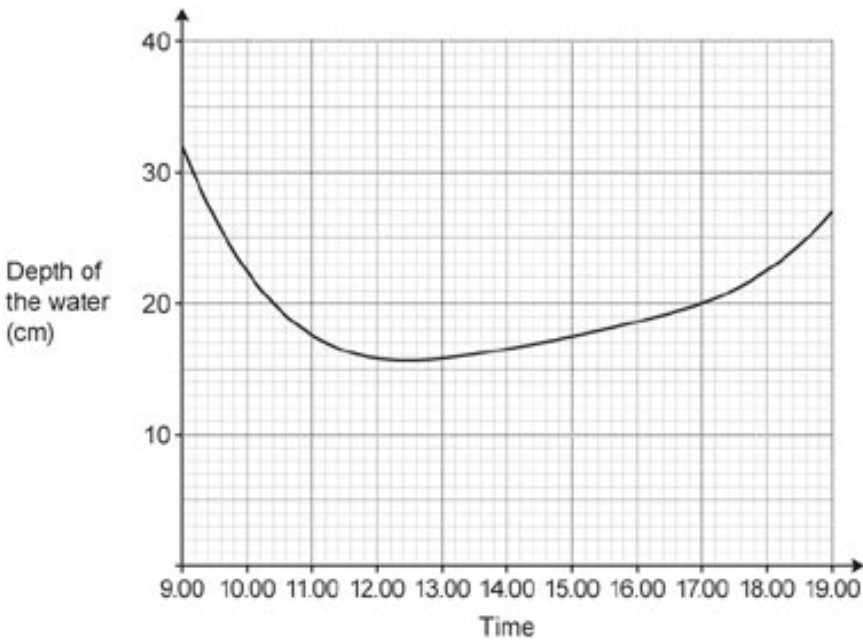
Graph

x : radius of a solid sphere made from clay

y : mass of the same solid sphere.

Graph

14(a). This graph shows the depth of the water, in centimetres, at a particular point in a river over a period of 10 hours.



Work out the average rate of change in the depth of the water over the 10 hours.

..... cm per hour **[4]**

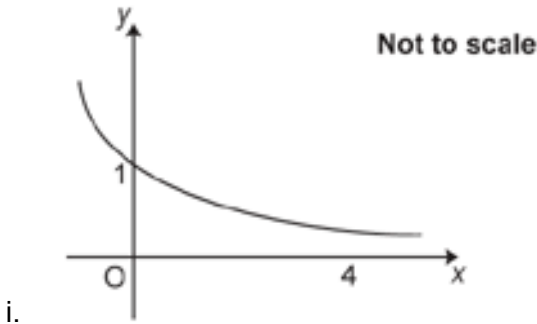
(b). Use the graph to estimate the rate of change in the depth of the water at 17.00. You must show working to support your estimate.

..... cm per hour **[4]**

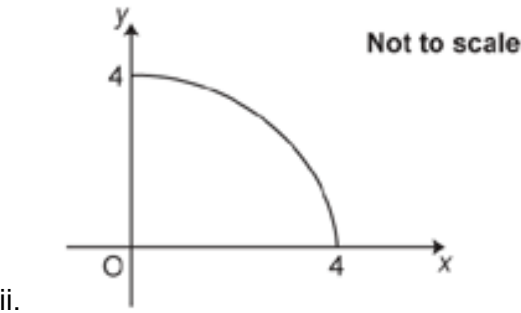
15(a). For each graph below, select its possible equation from this list.

$y = \sqrt{x-4}$ $y = 4^x$ $y = x^4$ $y = \frac{4}{x}$

$y = \left(\frac{1}{4}\right)^x$ $y = -4x^2$ $y = 4 \cos x$ $y = \sqrt{4^2 - x^2}$

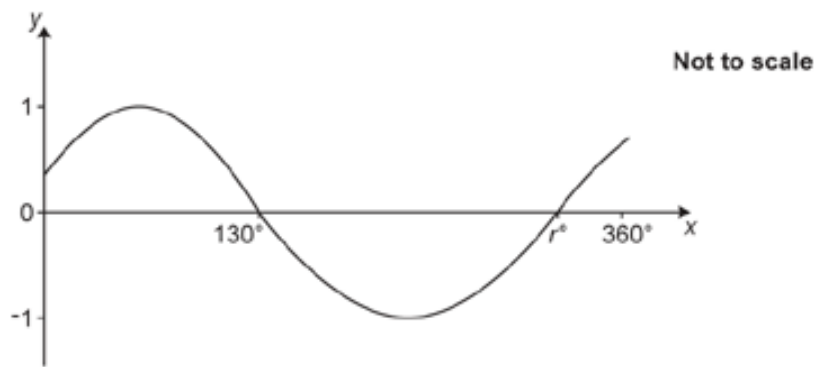


..... [1]



..... [1]

(b). A graph is drawn on the axes below.



The equation of the graph is $y = \sin(x + p)$, where $0^\circ \leq x \leq 360^\circ$.
The x-intercepts are 130° and r° .

Write down the value of p and the value of r .

$p =$
 $r =$ **[2]**

16. The expected value of a painting, £ P , is given by the formula

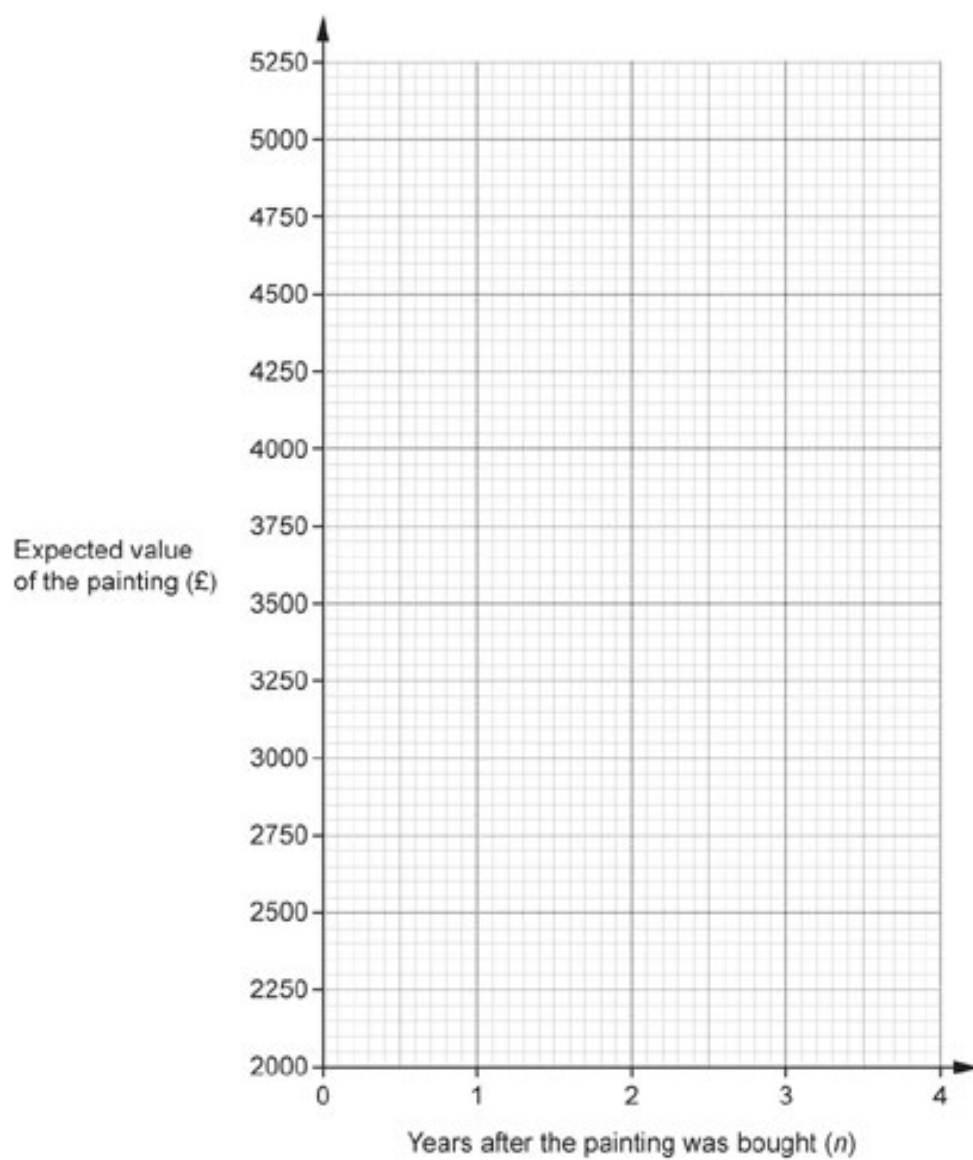
$P = 2500 \times 1.2^n$

where n is the number of years after it was bought and $0 \leq n \leq 4$.

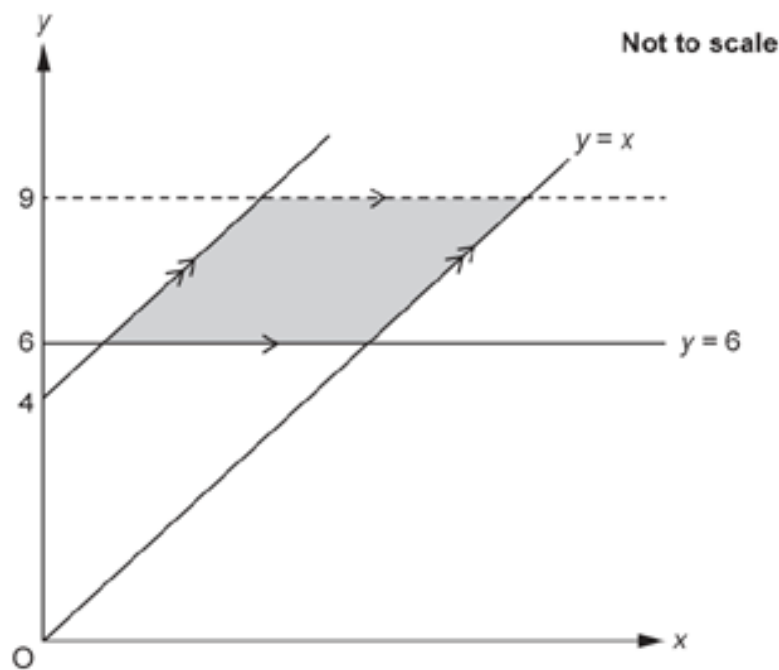
The table shows the expected value of the painting n years after it was bought.

Years after the painting is bought (n)	1	2	3	4
Expected value of the painting (£)	3000	3600	4320	5184

Draw a suitable graph to show the expected value of the painting n years after it was bought, where $0 \leq n \leq 4$.



17(a). In the diagram below, the shaded region is a parallelogram. The parallelogram can be identified by four inequalities. Two of the inequalities are $y \geq 6$ and $y \geq x$.



Write down the other **two** inequalities that identify the parallelogram.

.....

..... **[3]**

(b). Work out the area of the parallelogram. You must show your working.

..... square units **[4]**

18(a). A straight line has equation $y = 4x + 9$.

Write down the gradient of the line.

..... **[1]**

(b). Casey says the graph of $y = 4x + 9$ passes through the point (3, 23).

Is Casey correct?
Show how you decide.

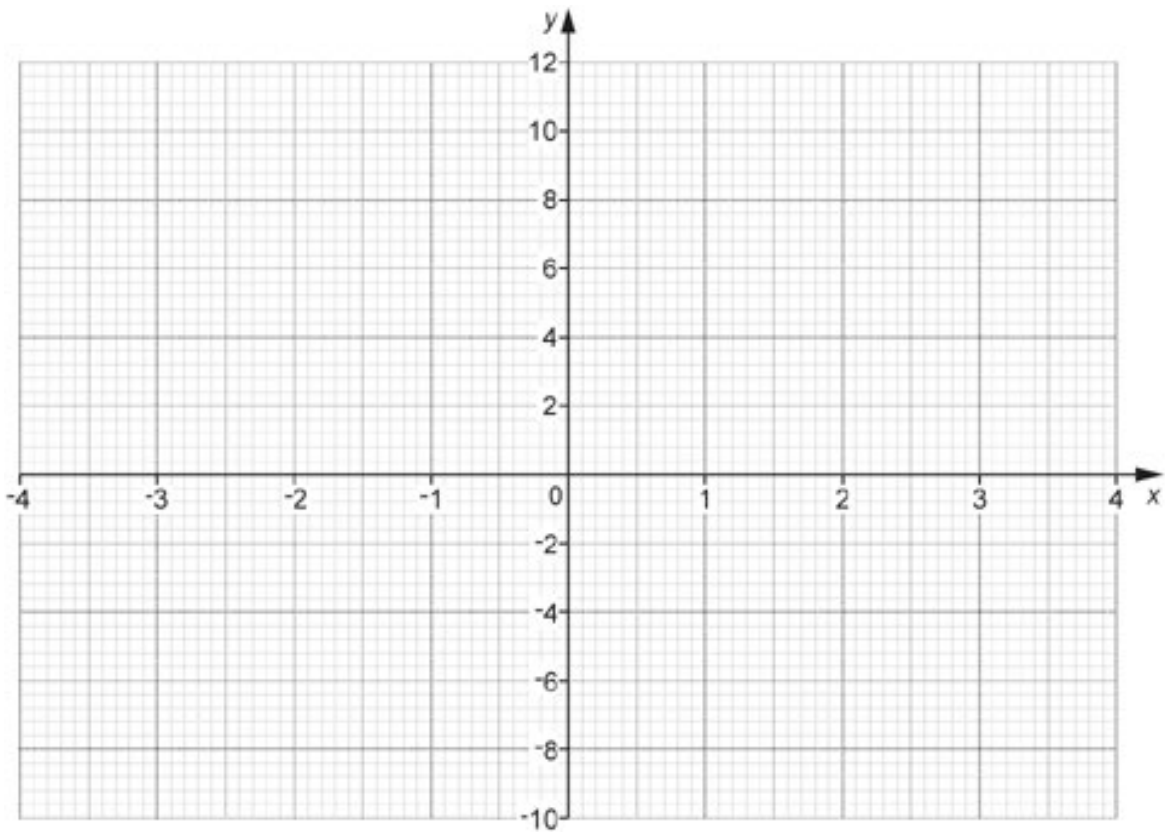
..... because

..... **[2]**

19(a). Here is a table of values for $y = x^2 - x - 8$.

x	-4	-3	-2	-1	0	1	2	3	4
y	12	4	-2	-6	-8	-8	-6	-2	4

Draw the graph of $y = x^2 - x - 8$ for $-4 \leq x \leq 4$.



[3]

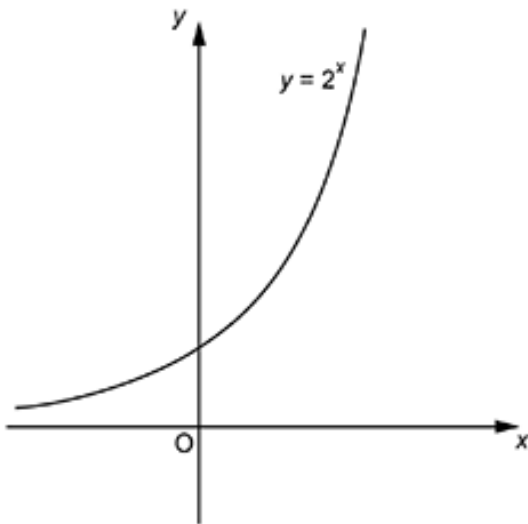
(b). Write down the equation of the line of symmetry of the graph.

..... [1]

(c). Use the graph to solve the equation $x^2 - x - 8 = 0$.
Give your answers to **1** decimal place.

$x =$ or $x =$ [2]

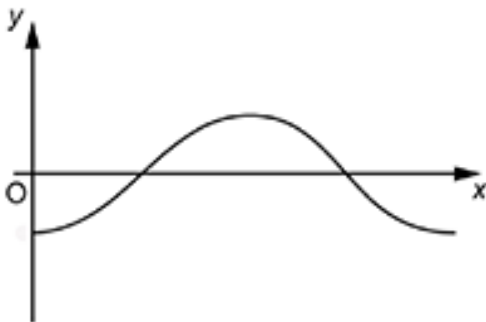
20(a). The graph of $y = 2^x$ is sketched below.



On the same axes, sketch the graph of $y = 3^x$.

[3]

(b). Sasha sketches this graph.



Sasha says

The equation of my graph is $y = \cos x$.

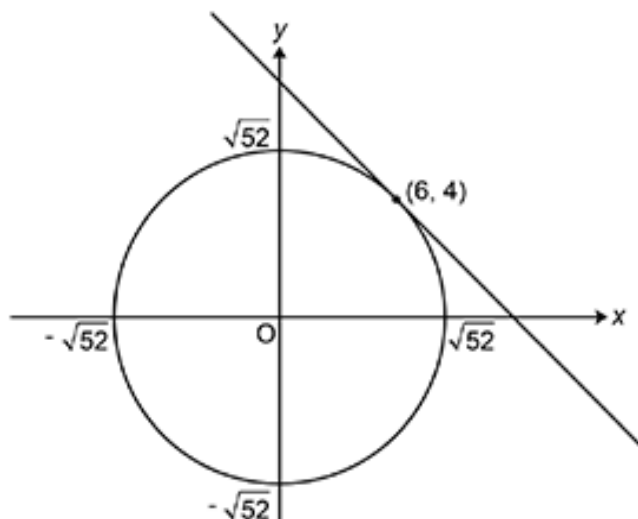
- i. Explain how you know that Sasha is **not** correct.

[1]

- ii. Write down a possible equation for Sasha's graph.

..... [1]

21(a). The diagram shows a circle, centre the origin, with the tangent to the circle at the point (6, 4).



Write down the equation of the circle.

..... [2]

(b).

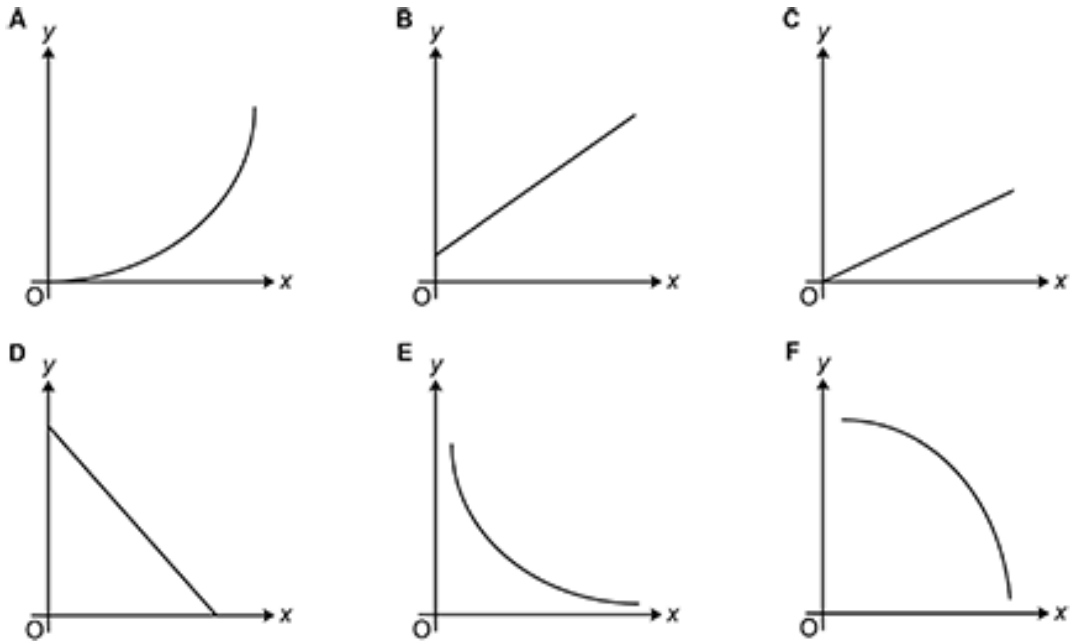
- i. Show that the tangent to the circle at the point (6, 4) has gradient $-\frac{3}{2}$.

[2]

- ii. Find the equation of the tangent to the circle at the point (6, 4).

..... [2]

22(a). Here are sketches of six graphs, labelled **A** to **F**.



Write the letter of the graph that represents the following relationships.

y is inversely proportional to x .
..... [1]

(b). y is directly proportional to x^2 .
..... [1]

23. Write down an equation for the line that is parallel to $y = 2x - 3$ and passes through the point $(0, 4)$.

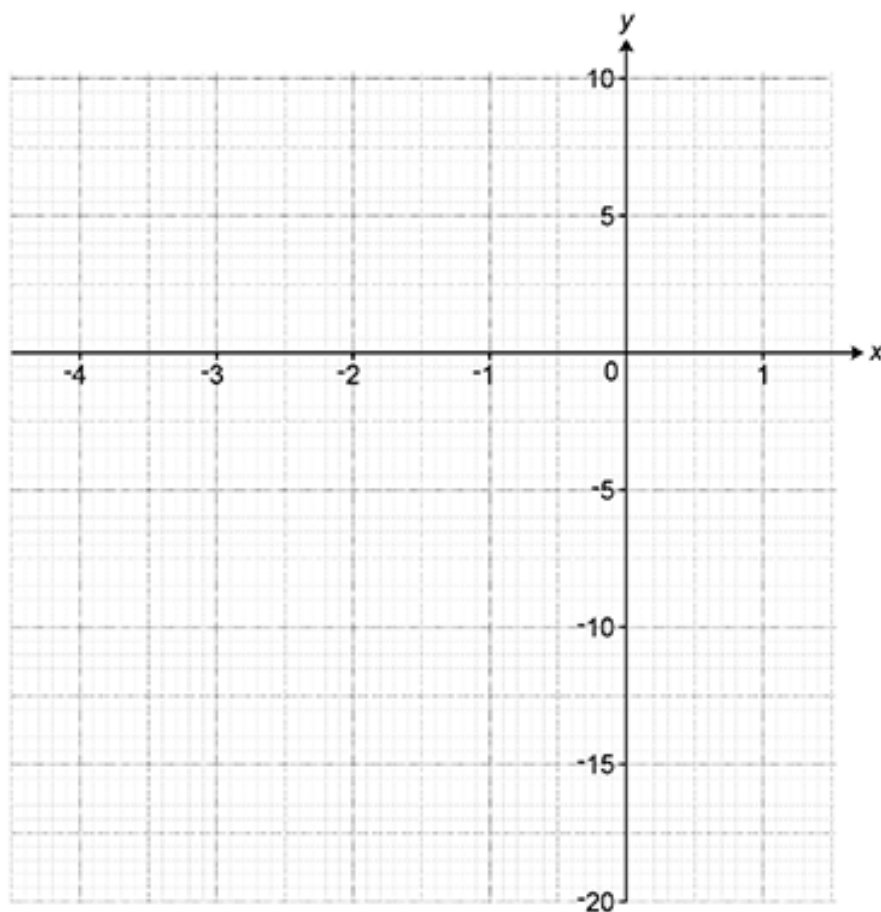
..... [2]

24(a). Complete the table for $y = x^3 + 3x^2$.

x	-4	-3.5	-3	-2.5	-2	-1	0	1
y	-16	-6.1	0	3.1	4		0	4

[1]

(b). Draw the graph of $y = x^3 + 3x^2$ for $-4 \leq x \leq 1$.



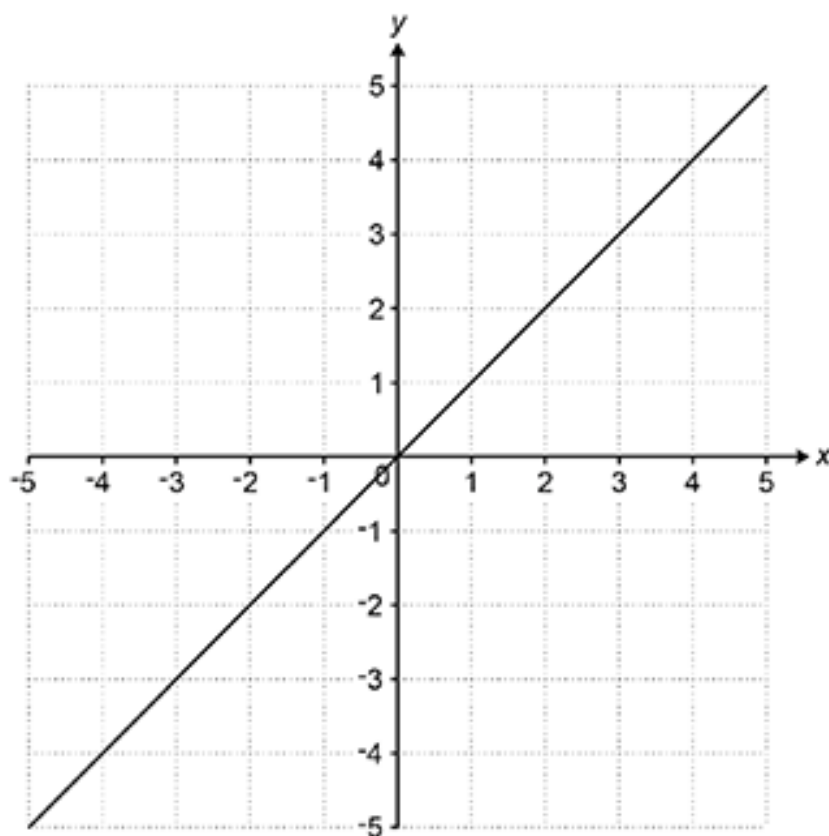
[3]

(c). The equation $x^3 + 3x^2 = k$ where k is an integer, has exactly one solution for $-4 \leq x \leq 1$.

Find the greatest possible value of k .

$k = \dots\dots\dots$ **[1]**

25. The graph of $y = x$ is drawn on the grid.

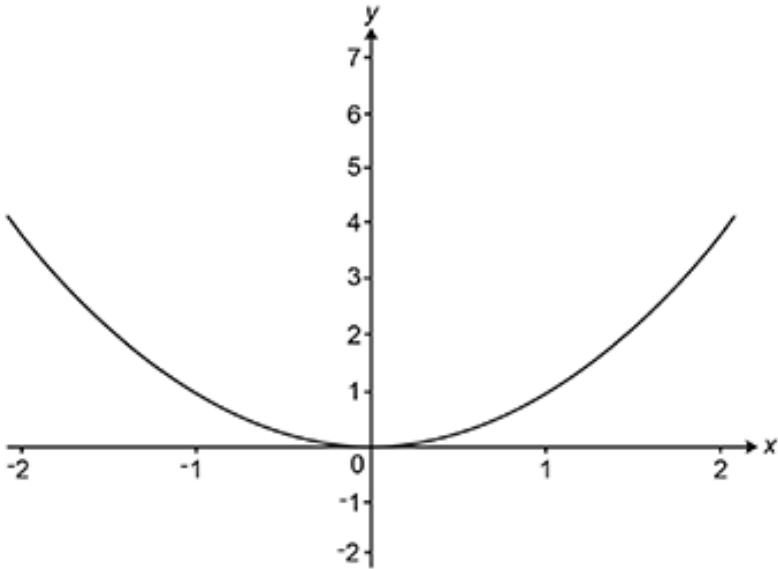


The region **R** satisfies the following inequalities.

$$y \leq x \quad y \geq -3 \quad y < -3x + 4$$

By drawing two more straight lines on the grid, find and label the region **R**.

26(a). The graph of $y = x^2$ is shown below for $-2 \leq x \leq 2$.



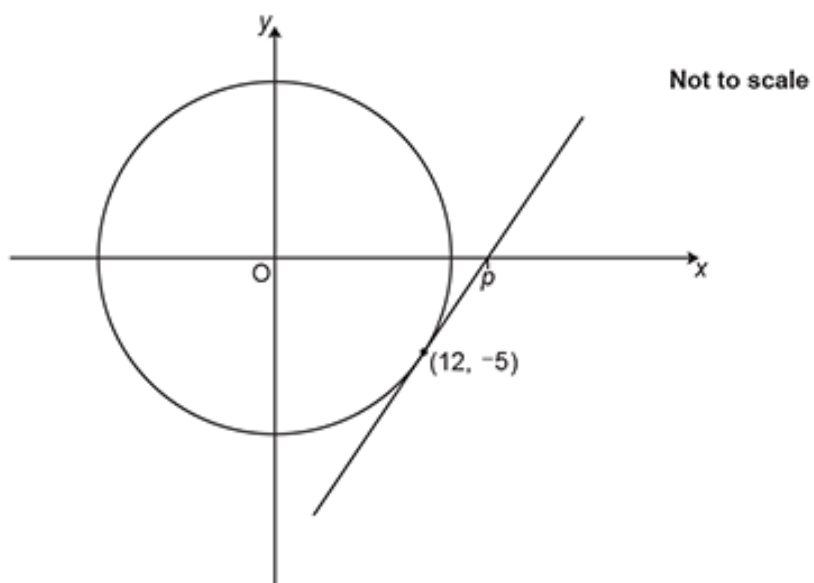
Find the equation of the image when $y = x^2$ is reflected in the line $y = 3$.

..... [2]

(b). Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 4x - 7$.

..... [4]

27. The diagram shows a circle with centre $(0, 0)$ and a tangent at $(12, -5)$.
The tangent at $(12, -5)$ crosses the x -axis at $(p, 0)$.



Find the exact value of p .
You must show your working.

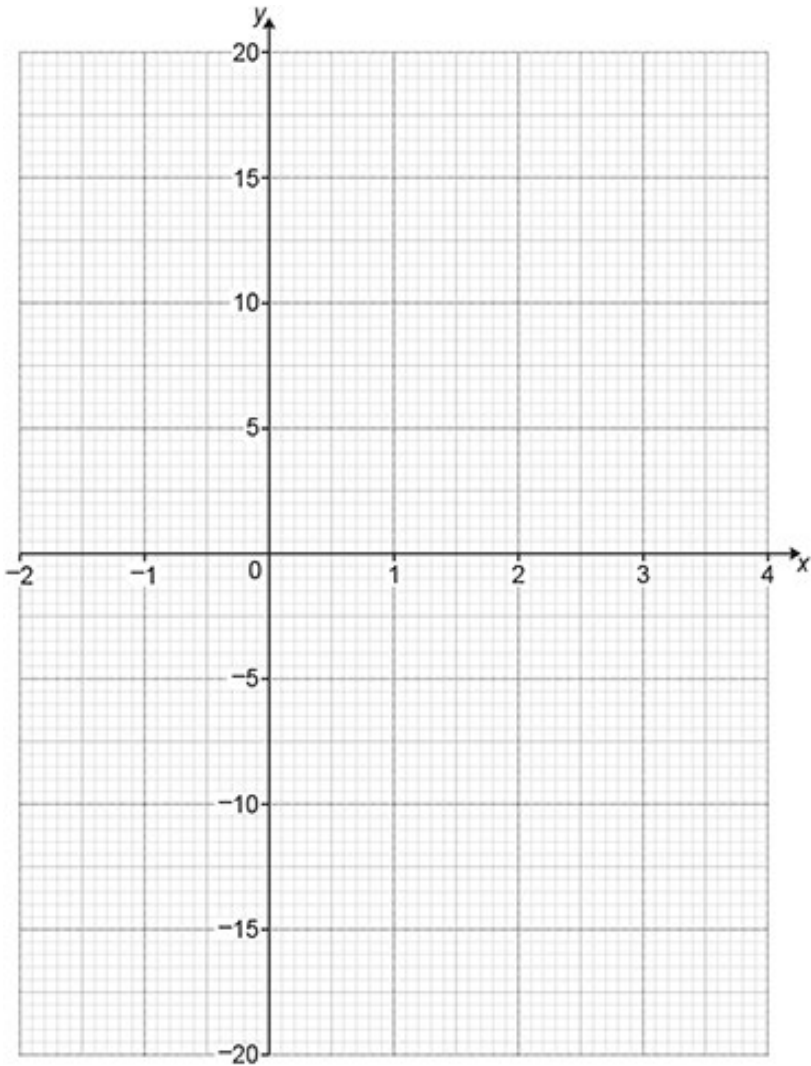
$p = \dots\dots\dots$ **[5]**

28(a). Complete this table for $y = x^3 - 3x^2$

x	-2	-1	0	1	2	3	4
y	-20		0	-2	-4		16

[2]

(b). Draw the graph of $y = x^3 - 3x^2$ for values of x from -2 to 4.

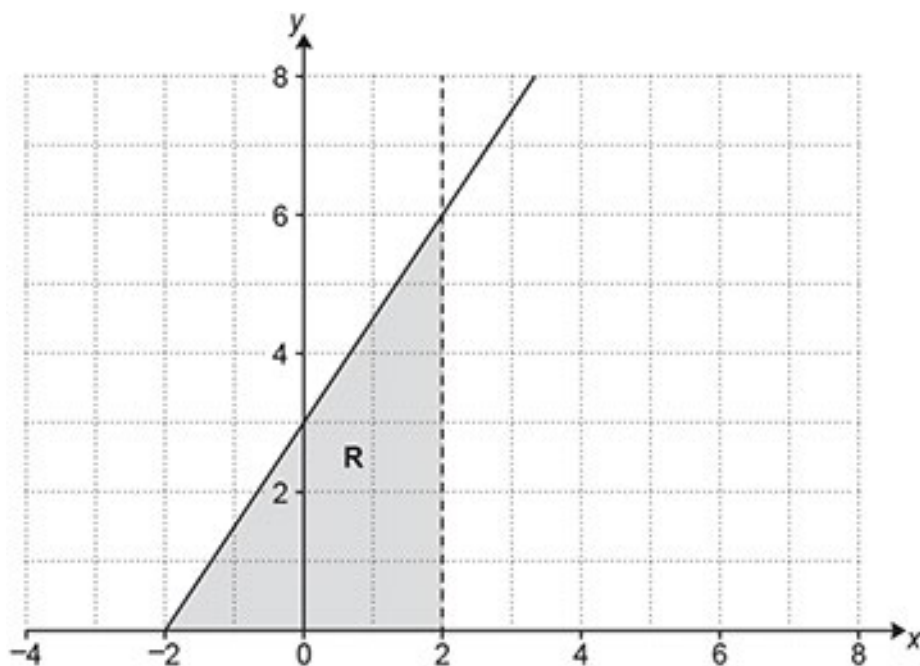


[3]

(c). Use the graph to solve the equation $x^3 - 3x^2 = 5$.
Give your answer to 1 decimal place.

..... [1]

29. The region **R** is shown on this grid.



The region **R** is defined by three inequalities.

The first inequality is given below.

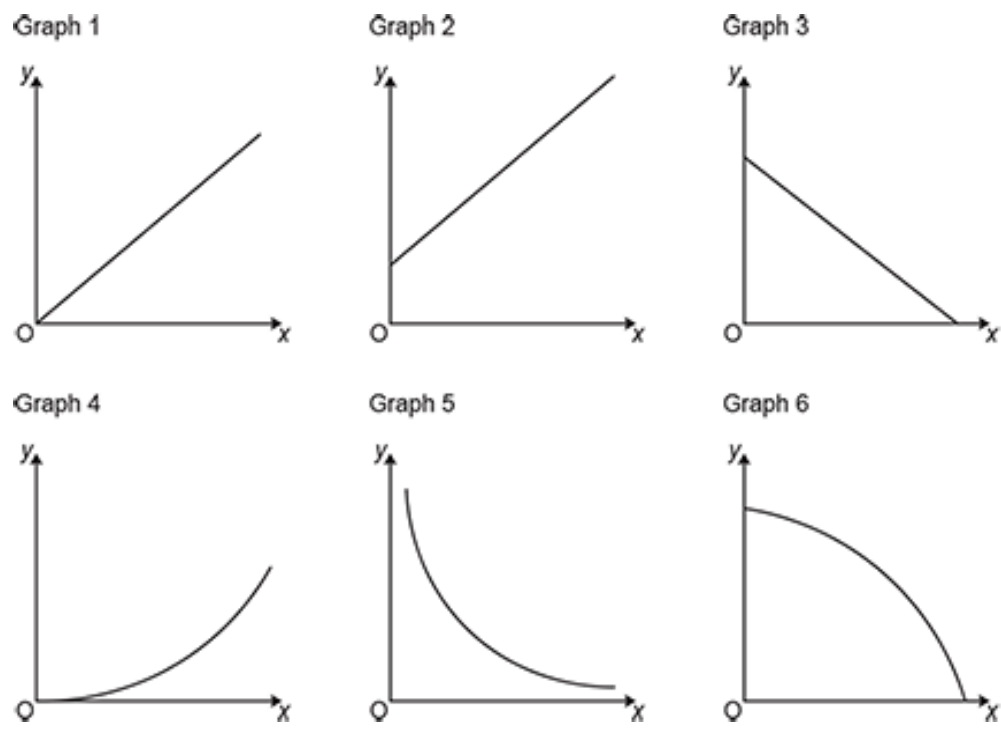
Complete the second inequality and write down the third inequality needed to define region **R**.

$$y \geq 0$$

$$2y \dots\dots\dots 3x + 6$$

.....

30. Below are six graphs, numbered 1 to 6, that show different relationships between x and y .



For each description below, write down the number of the graph that best represents the relationship between x and y .

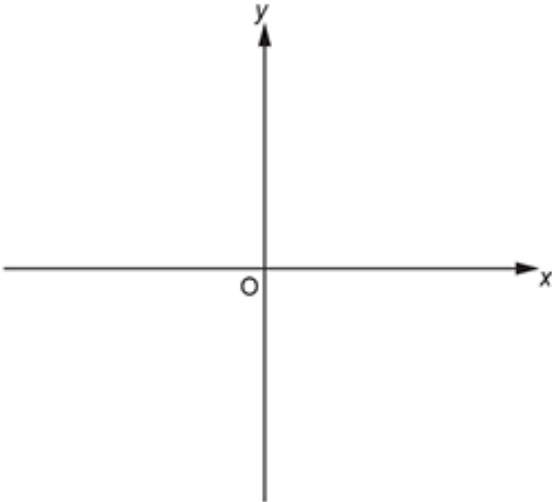
- x: temperature in $^{\circ}\text{C}$
y: temperature in $^{\circ}\text{F}$, where $y = 1.8x + 32$.
- x: average speed when running 200 m
y: time taken to run 200 m.
- x: mass of a solid object made from clay
y: volume of the same solid object.

Graph

Graph

Graph

31(a). Sketch the graph of $y = 8^x$.
Indicate any values where the graph crosses the axes.



[2]

(b). Sketch the graph of $y = \cos x$ for $0^\circ \leq x \leq 360^\circ$.
Indicate any values where the graph crosses the x-axis.



[2]

32.

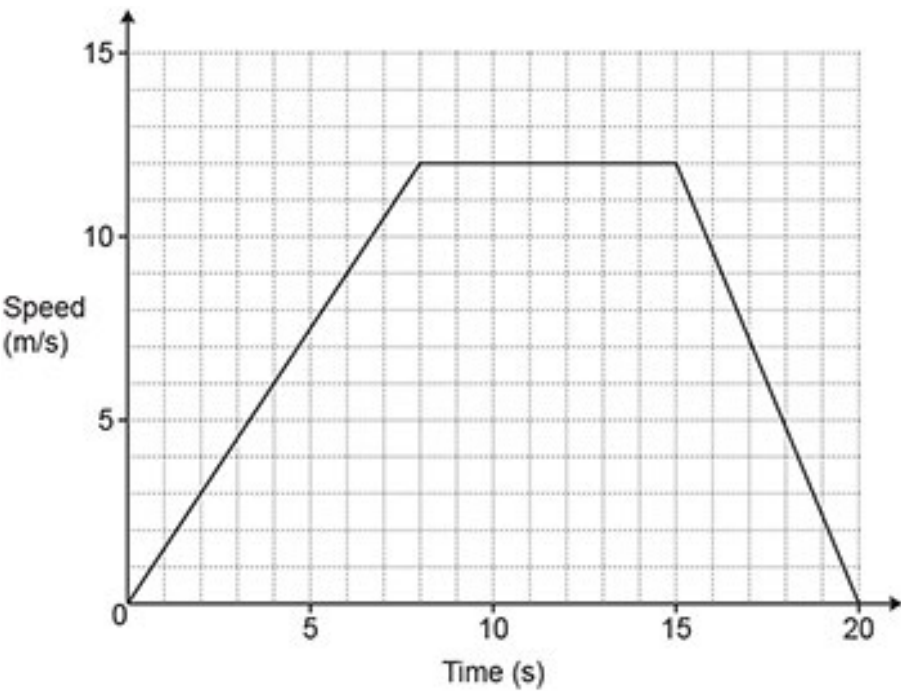
- i. Write down the coordinates of the turning point of the graph $y = (x - 3)^2 + 8$.

(..... ,) [2]

ii. Describe the **single** transformation which maps the graph of $y = x^2$ onto the graph of $y = (x - 3)^2 + 8$.

..... [2]

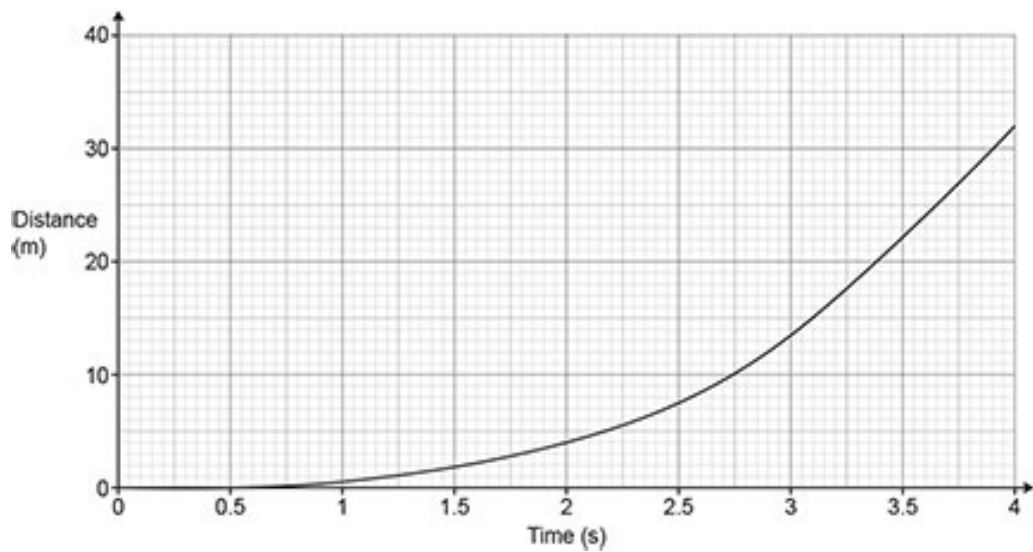
33(a). The graph shows the speed of an object during the first 20 seconds of its motion.



Calculate the distance travelled by the object during the 20 seconds.

..... m [3]

(b). The graph shows the distance travelled by an object during the first 4 seconds of its motion.



i. Work out the average speed of this object between 2 and 4 seconds.

..... m/s [2]

ii. Use the graph to estimate the speed of this object at 3 seconds.
You must show working to support your estimate.

..... m/s [3]

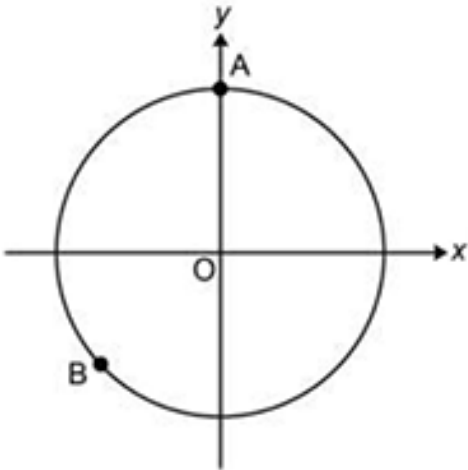
iii. What happens to the speed of this object during these 4 seconds of motion.
Explain how you know.

The speed _____

I know this because _____

..... [1]

34(a). A circle has equation $x^2 + y^2 = 100$.
The sketch shows the circle and two points, A and B, which lie on the circumference of the circle.



Write down the coordinates of point A.

(..... ,) **[1]**

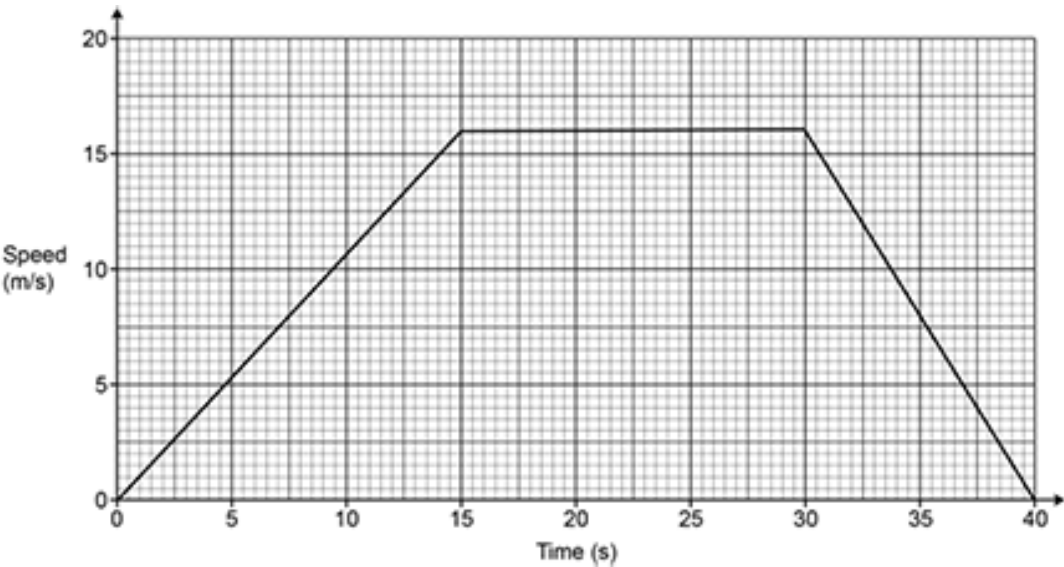
(b). Point B has x -coordinate -7 .
Find the exact value of the y -coordinate of point B.

..... **[3]**

(c). Another point, C, lies on the circle and has an x -coordinate that is three times its y -coordinate.
Find the two possible pairs of coordinates for point C.
Give your answers in exact form.
You must show your working.

(..... ,) and (..... ,) **[5]**

35(a). The graph shows the speed of a car during the first 40 seconds of a journey.



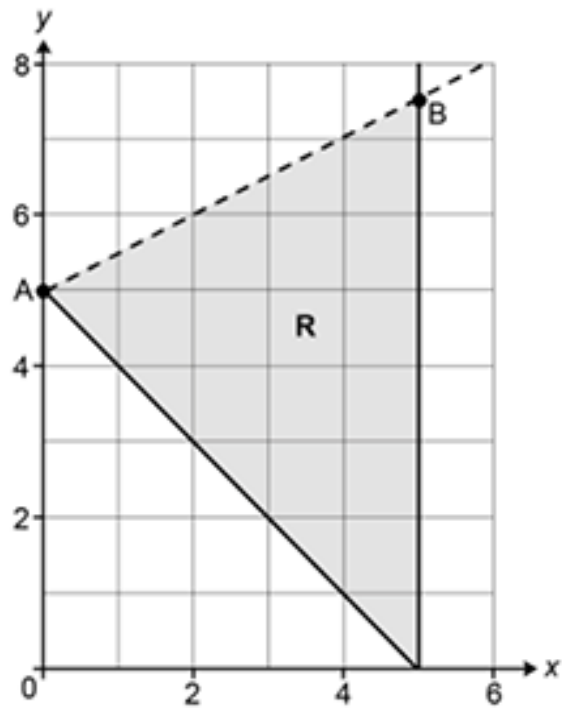
Write down the acceleration of the car between 15 seconds and 30 seconds.

.....m/s² **[1]**

(b). Work out the average speed of the car, in m/s, during the 40 seconds.
You must show your working.

..... m/s **[5]**

36(a). The region **R** is shown on this grid.
A is the point (0, 5) and B is the point (5, 7.5).



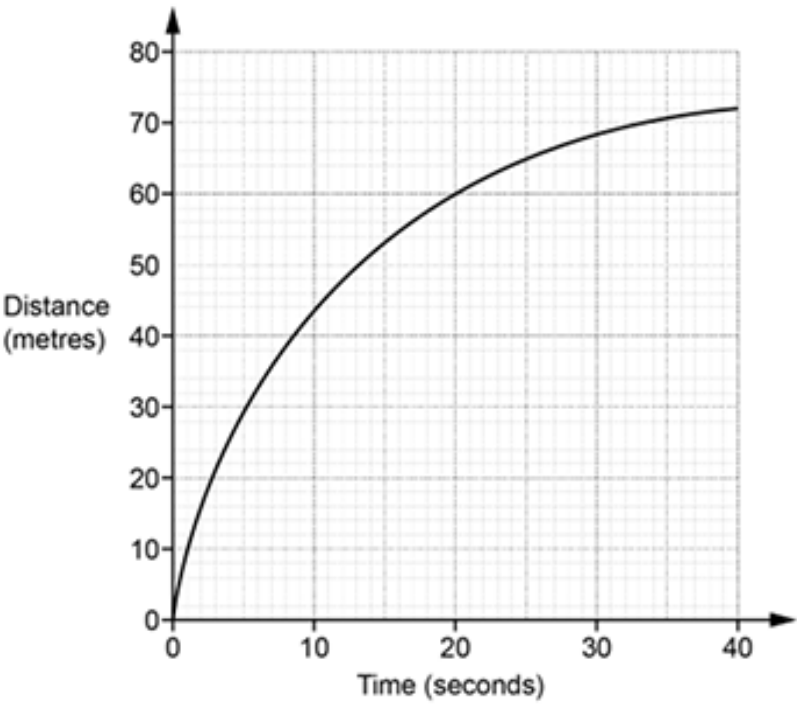
Show that an equation of the straight line through A and B is $2y = x + 10$.

[3]

(b). Write down the three inequalities that define region **R**.

.....
.....
..... [5]

37(a). The graph shows the distance travelled by a particle over the first 40 seconds of its motion.



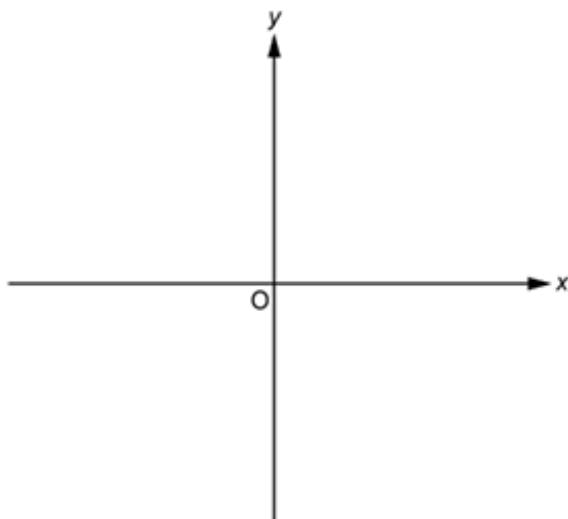
Show that the average speed of the particle over the first 40 seconds of its motion is 1.8 m/s.

[1]

(b). Estimate the speed of the particle at 20 seconds.
You must show working to support your estimate.

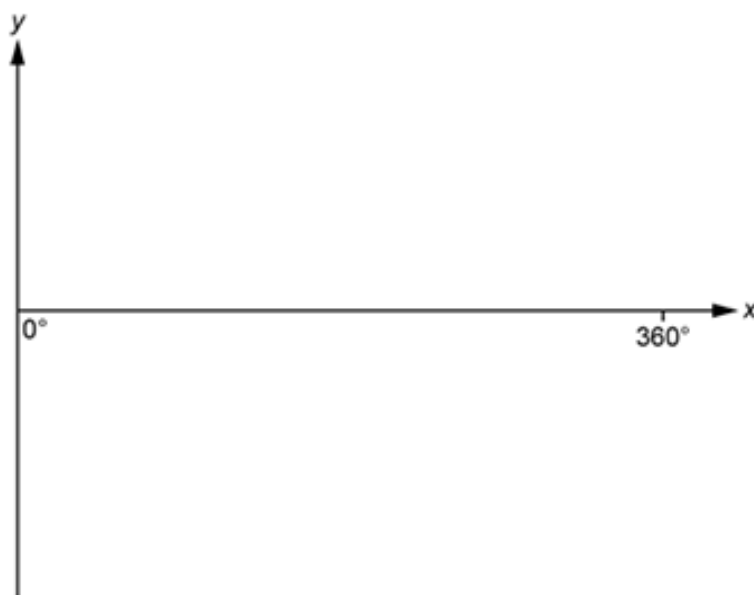
..... m/s [3]

38(a). Sketch the graph of $y = 3^{-x}$ indicating any values where the graph crosses the axes.



[2]

(b). Sketch the graph of $y = \sin x$ for $0^\circ \leq x \leq 360^\circ$ indicating any values where the graph crosses the axes.



[2]

39. Find the equation of the line through $(-4, 5)$ that is perpendicular to $y = \frac{1}{2}x + 3$.

..... [3]

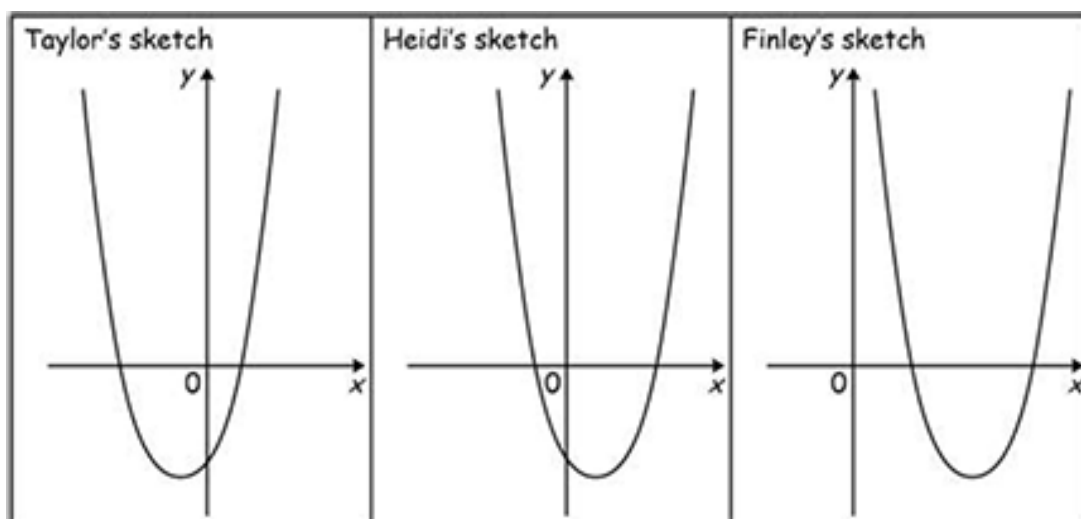
40. Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = (x - 2)^2 + 1$.

----- [3]

41. Describe fully the graph of $x^2 + y^2 = 10$.

----- [3]

42. Taylor, Heidi and Finley all attempt to sketch the graph of $y = (2x + 5)(x - 4)$.



Whose sketch is the most accurate?

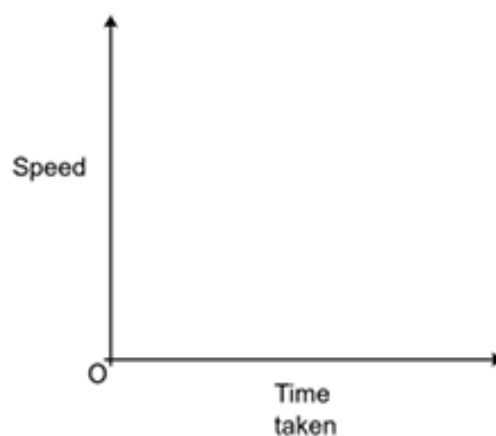
Write down the properties of the graph that you used in making your decision.

_____ because _____

_____ [2]

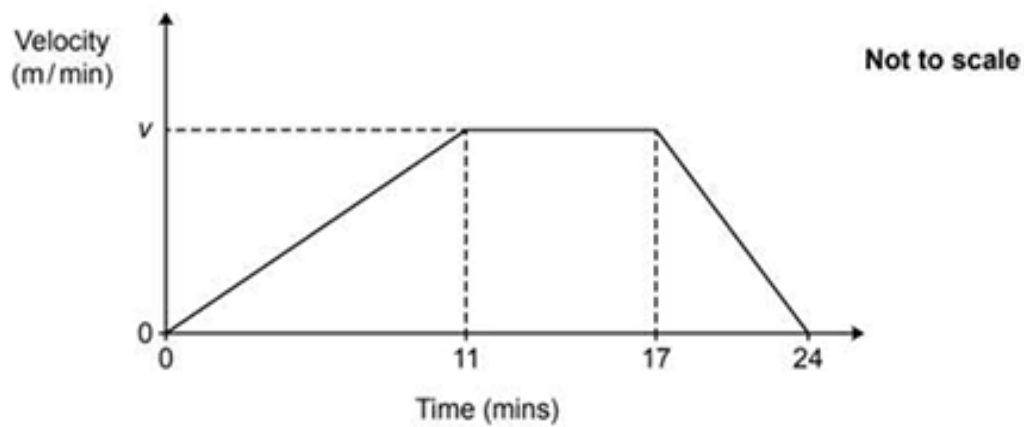
43. The time taken to complete a journey doubles as the speed halves.

On the axes below, sketch a graph to show this relationship.



[2]

44. The graph shows the velocity of a particle over the first 24 minutes of its motion.

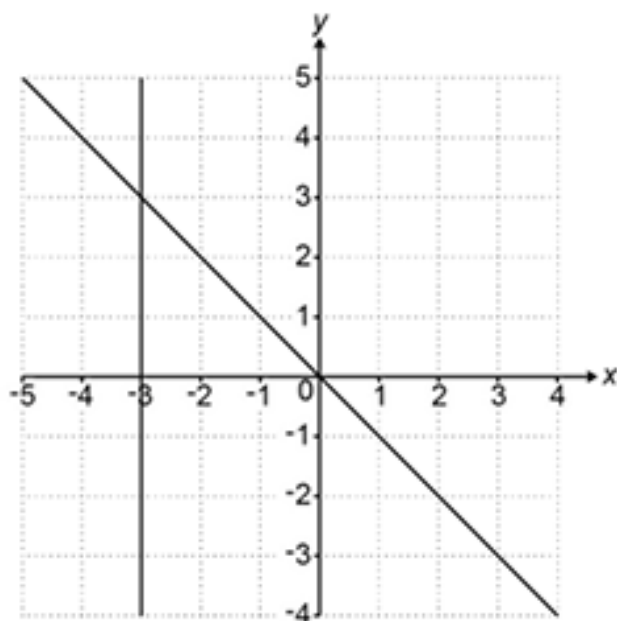


Between 11 minutes and 17 minutes the velocity of the particle is v metres per minute.
The average velocity of the particle over the 24 minutes is 10.25 metres per minute.

Find the value of v .
You must show your working.

$v = \dots\dots\dots$ [5]

45. The graphs of $x = -3$ and $y = -x$ are drawn on the grid.



The region **R** satisfies the following inequalities.

$$x \geq -3 \qquad y \leq -x \qquad y - 2 < \frac{1}{3}x$$

By drawing one more line, find and label the region **R**.

46. A rhombus is drawn on a coordinate grid.

One diagonal of the rhombus has equation $y = \frac{1}{3}x + 4$.

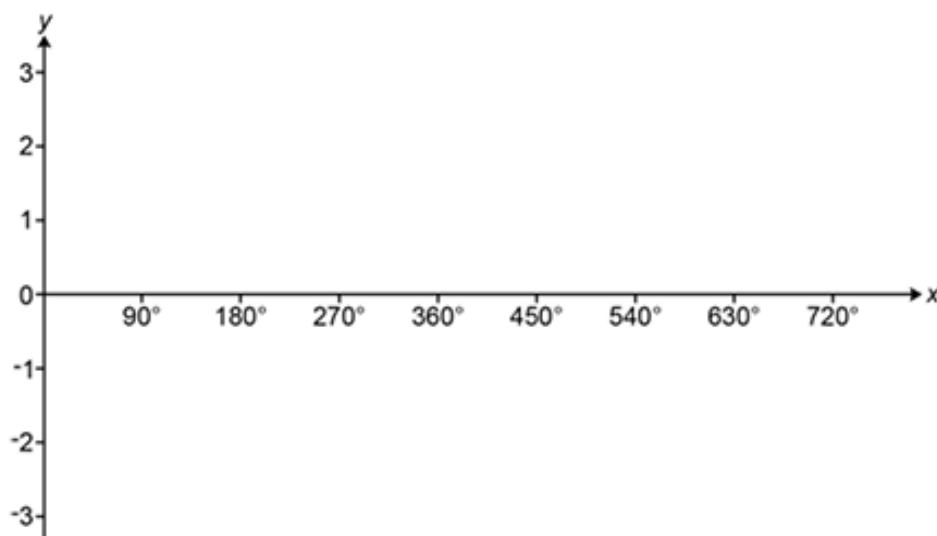
The other diagonal passes through the point (2, 5).

Find the equation of the other diagonal of the rhombus.

Give your answer in the form $y = mx + c$.

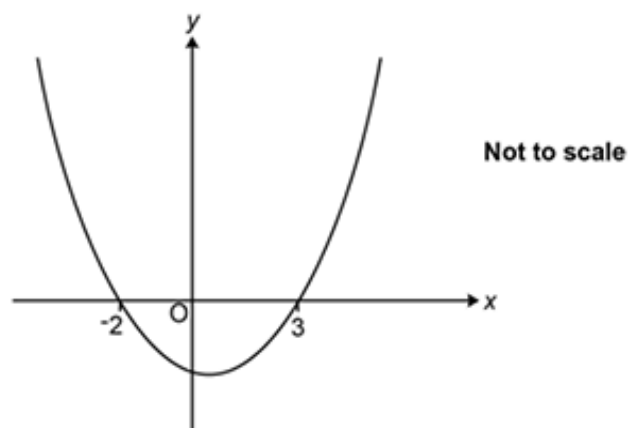
$y = \dots\dots\dots$ **[4]**

47. Sketch the graph of $y = \sin x + 1$ for $0^\circ \leq x \leq 720^\circ$.



[3]

48(a). Charlie sketches this quadratic graph.



Charlie says

The y-intercept is -6.

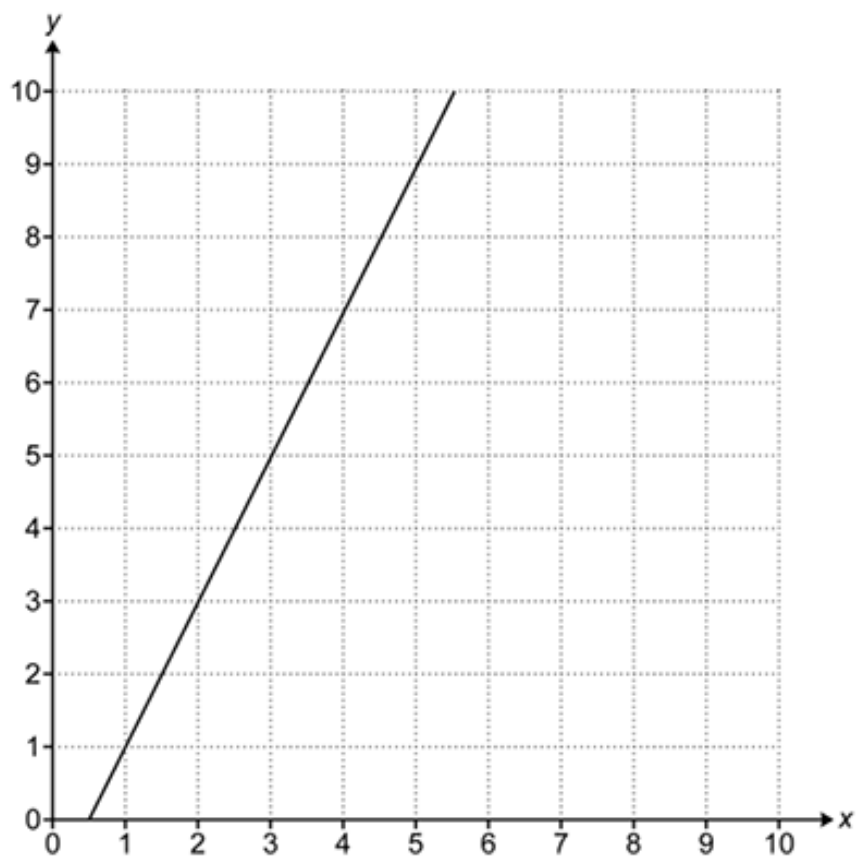
Show that what Charlie says could be correct.

[3]

(b). Explain why what Charlie says may **not** be correct.

[2]

49. The graph of $y = 2x - 1$ is drawn on this one centimetre grid.



The region **R** satisfies these inequalities.

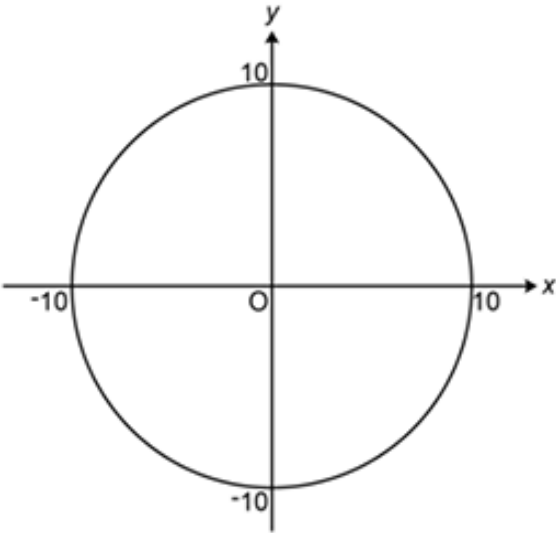
$$y \geq 2x - 1$$

$$y \leq 7$$

$$x + y \geq 8$$

Show that the area of region **R** is 3 cm^2 .

50(a). The graph below shows a circle with centre (0, 0) and equation $x^2 + y^2 = 100$.



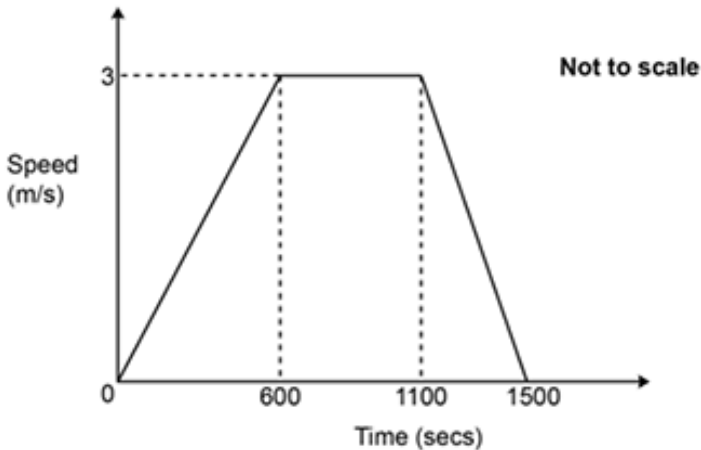
Show that the point (8, -6) lies on the circumference of the circle.

[2]

(b). Find the equation of the tangent to the circle at the point (8, -6), giving your answer in the form $y = mx + c$.

..... [5]

51(a). Harper goes for a training run.
The graph shows their speed as they run.



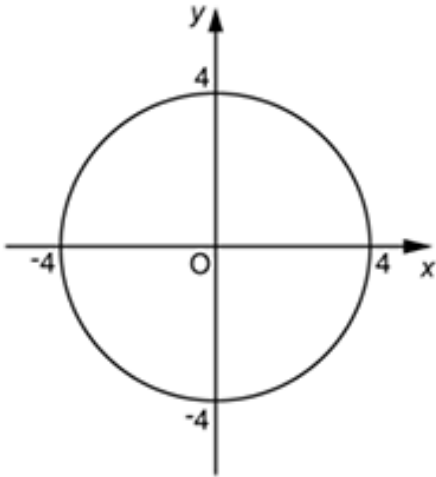
Write down Harper’s acceleration between 600 seconds and 1100 seconds.

..... m/s² **[1]**

(b). Work out Harper’s average speed, in m/s, during the 1500 seconds.
You must show your working.

..... m/s **[5]**

52. The diagram shows a circle, centre the origin.



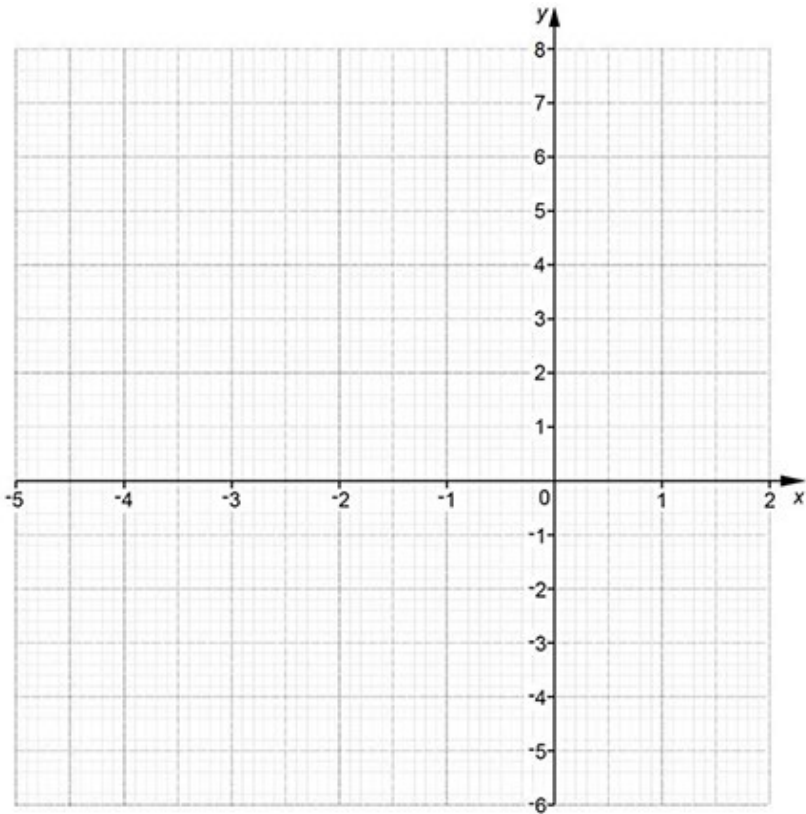
Write down the equation of the circle.

..... [2]

53(a). Here is a table of values for $y = x^2 + 3x - 3$.

x	-5	-4	-3	-2	-1	0	1	2
y	7	1	-3	-5	-5	-3	1	7

Draw the graph of $y = x^2 + 3x - 3$ for $-5 \leq x \leq 2$.



(b). Write down the equation of the line of symmetry of the graph.

..... **[1]**

(c). Use the graph to solve the equation $x^2 + 3x - 3 = 0$.
Give your answers to **1** decimal place.

$x =$ or $x =$ **[2]**

54. A straight line passes through the point $(6, -3)$ and is perpendicular to the line $y = 3x + 2$.

Find the equation of the line, giving your answer in the form $y = mx + c$.

..... **[4]**

55. The point $(4, 6\sqrt{3})$ lies on the circumference of a circle, centre $(0, 0)$.

Find the equation of the circle.

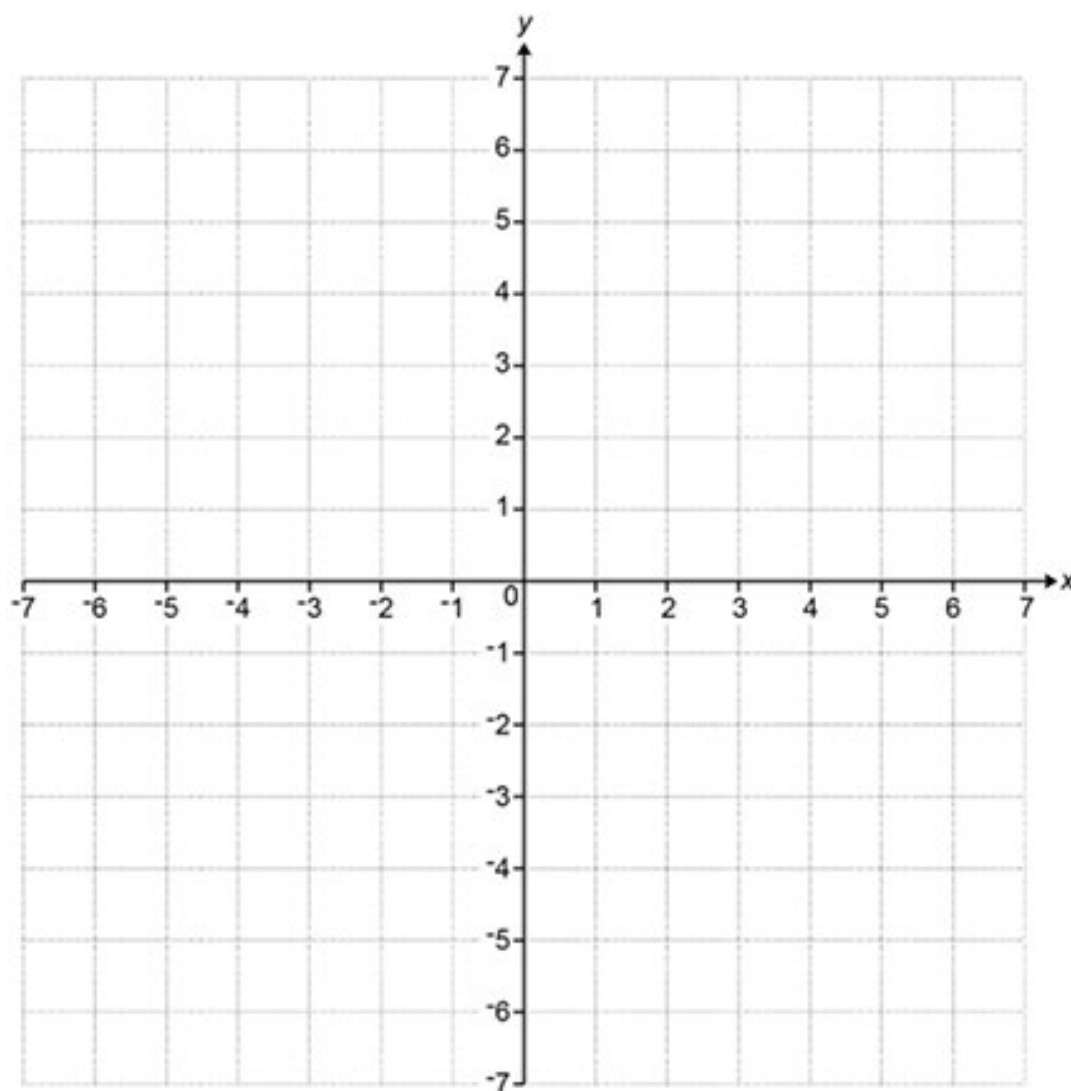
..... **[4]**

56(a). Complete the table for $y = 1 + \frac{6}{x}$.

x	-6	-3	-2	-1	1	2	3	6
y	0		-2	-5	7	4	3	2

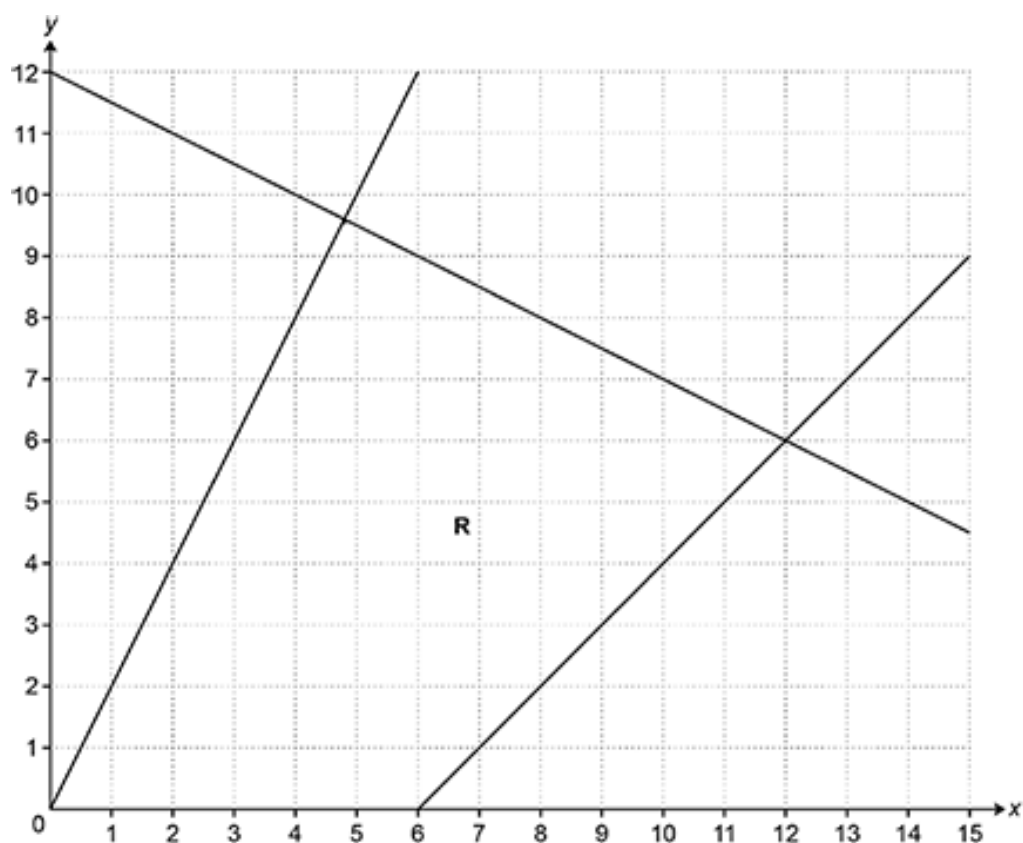
[1]

(b). Draw the graph of $y = 1 + \frac{6}{x}$ for $-6 \leq x \leq 6$, $x \neq 0$.



[3]

57(a). The region **R** is shown on this grid.



Region **R** is defined by four inequalities.
One of the inequalities is $y \geq 0$.

Use the symbols $\leq$ and $\geq$ to complete the other three inequalities.

$$y \geq 0$$

$$y \dots\dots\dots 2x$$

$$x + 2y \dots\dots\dots 24$$

$$y \dots\dots\dots x - 6$$

(b). The inequality $y \geq 0$ is replaced by a new inequality.
Region **R** is then a trapezium.
The point (6, 0) is still one of the corners of Region **R**.

Write down the new inequality.

..... **[3]**

58. Find the coordinates of the turning point of the graph of $y = x^2 - 8x + 5$.

(..... ,) **[4]**

59(a). For each graph below, select its possible equation from this list.

- $y = x$

$y = \sin x$

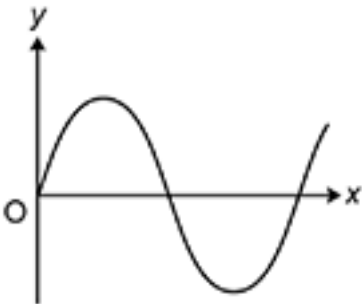
$y = 3^x$
- $y = x^2$

$y = \cos x$

$y = \left(\frac{1}{3}\right)^x$
- $y = \frac{1}{x}$

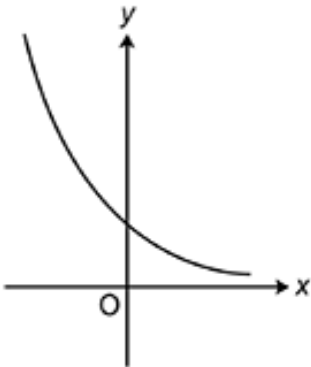
$y = \tan x$

i.



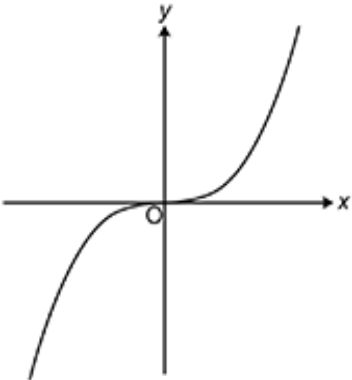
$y =$ **[1]**

ii.



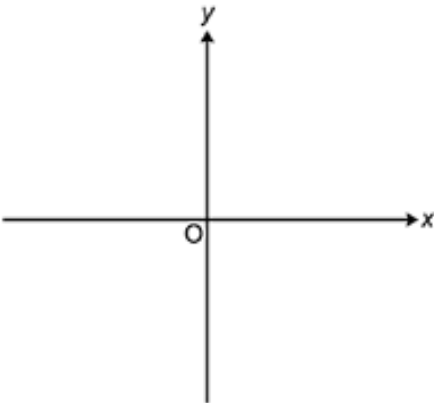
y = [1]

(b). Here is a sketch of $y = x^3$.



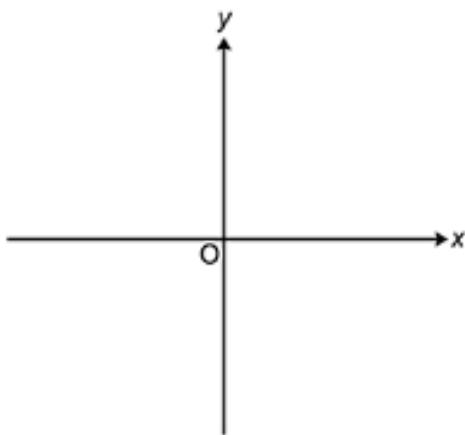
On the axes below, sketch the graphs of

i. $y = \frac{1}{2}x^3$



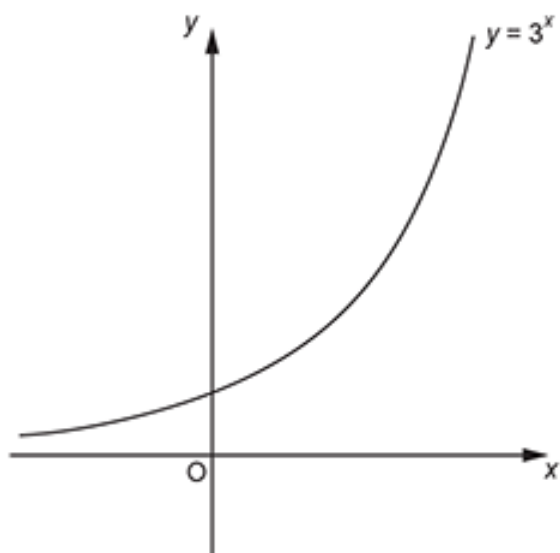
[1]

- ii. $y = x^3 + 8$, showing the values of any intercepts with the axes.



[3]

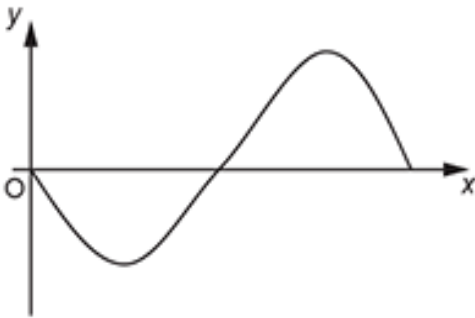
- 60(a). The graph of $y = 3^x$ is sketched below.



- On the same axes, sketch the graph of $y = 2^x$.

[3]

(b). Charlie sketches this graph.



Charlie says

The equation of my graph is $y = \sin x$.

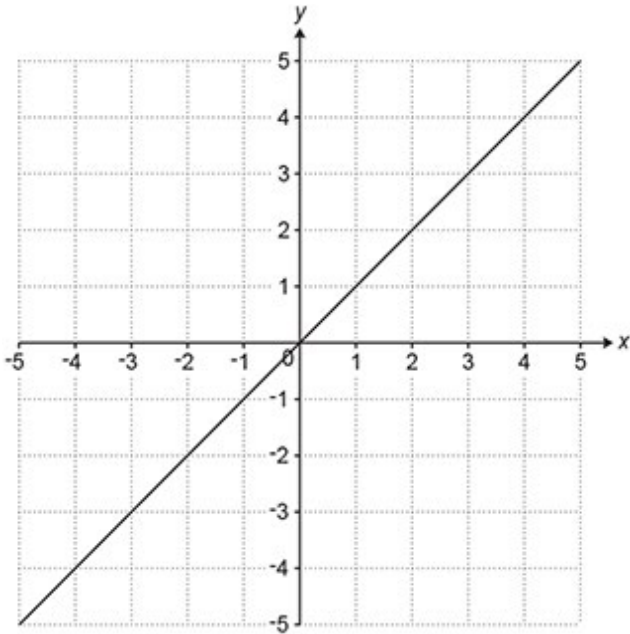
- i. Explain how you know that Charlie is **not** correct

[1]

- ii. Write down a possible equation for Charlie's graph.

[1]

61. The graph of $y = x$ is drawn on the grid.



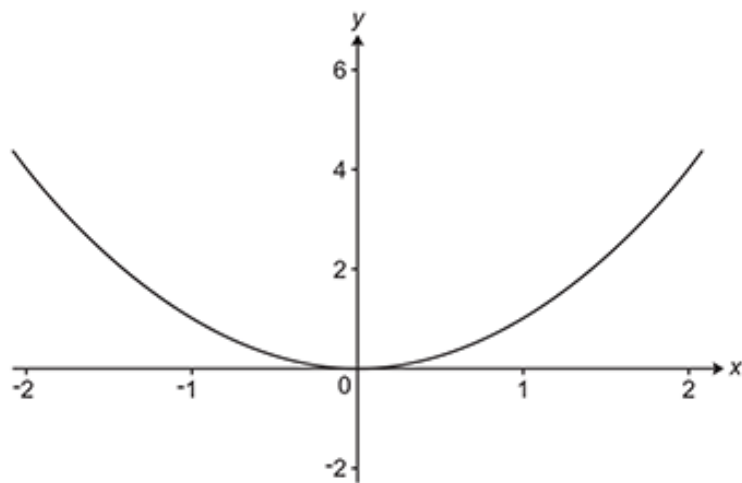
The region **R** satisfies the following inequalities.

$y \geq x$ $y \leq 2$ $y < -2x - 3$

By drawing two more straight lines on the grid, find and label the region **R**.

[6]

62(a). The graph of $y = x^2$ is shown below for $-2 \leq x \leq 2$.



Find the equation of the image when $y = x^2$ is reflected in the line $y = 2$.

..... [2]

(b). Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = x^2 + 6x - 5$.

..... [4]

63. Write down an equation for the line that is parallel to $y = 3x - 5$ and passes through the point $(0, 1)$.

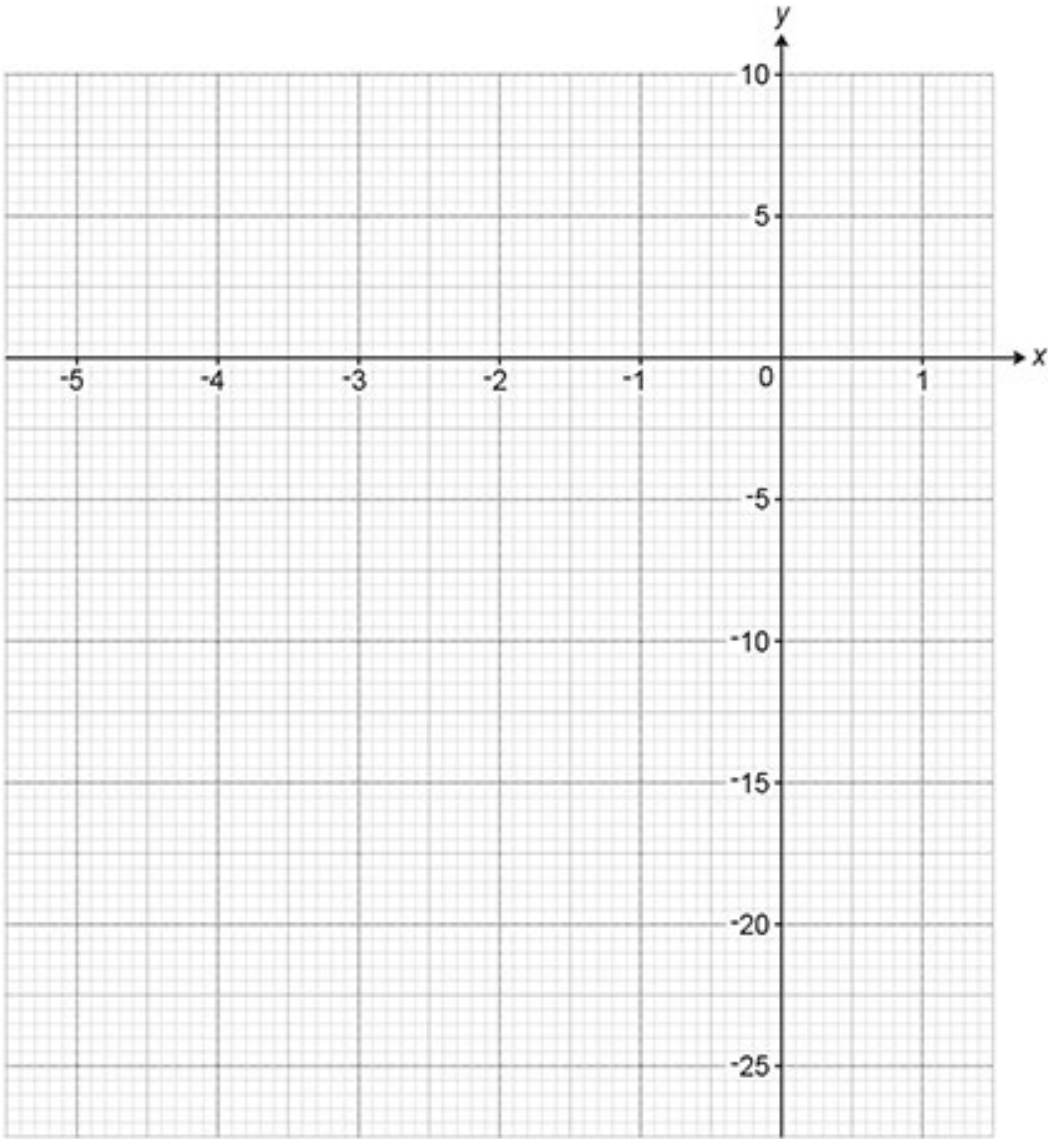
..... [2]

64(a). Complete the table for $y = x^3 + 4x^2$.

x	-5	-4.5	-4	-3	-2	-1	0	1
y	-25	-10.1	0	9	8		0	5

[1]

(b). Draw the graph of $y = x^3 + 4x^2$ for $-5 \leq x \leq 1$.

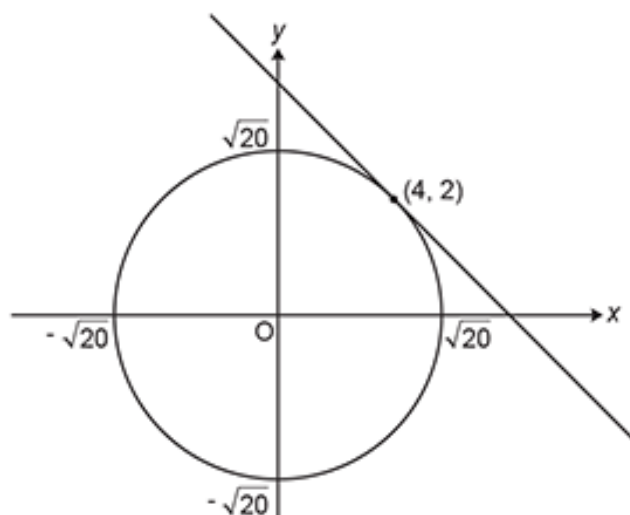


[3]

(c). The equation $x^3 + 4x^2 = k$, where k is an integer, has exactly one solution for $-5 \leq x \leq 1$.
Find the greatest possible value of k .

$k = \dots\dots\dots$ [1]

65(a). The diagram shows a circle, centre the origin, with the tangent to the circle at the point $(4, 2)$.



Write down the equation of the circle.

..... [2]

(b).

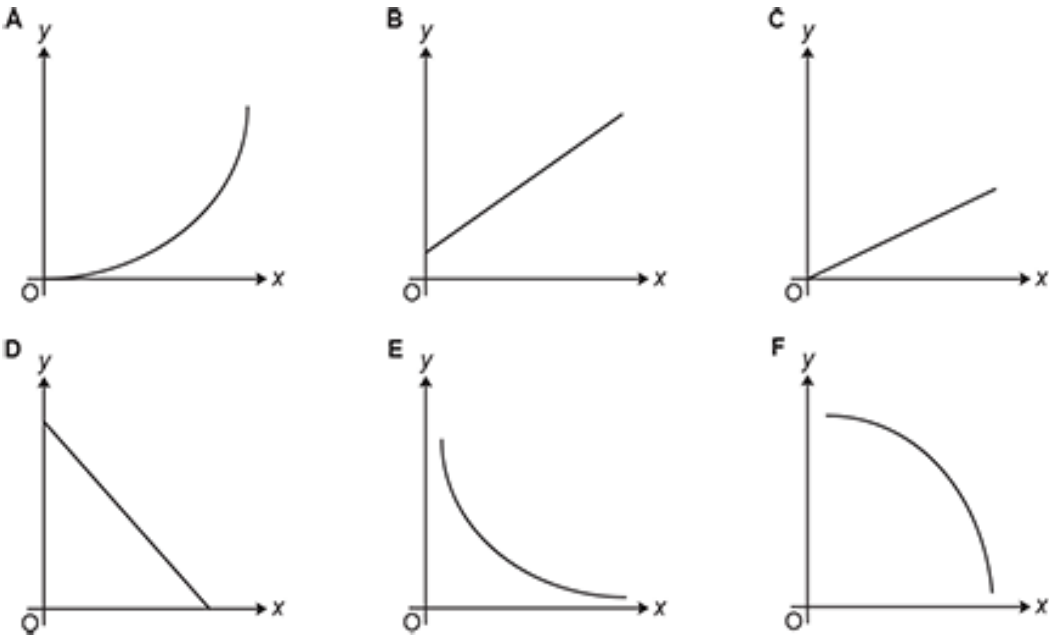
- i. Show that the tangent to the circle at the point $(4, 2)$ has gradient -2 .

[2]

- ii. Find the equation of the tangent to the circle at the point $(4, 2)$.

..... [2]

66(a). Here are sketches of six graphs, labelled **A** to **F**.

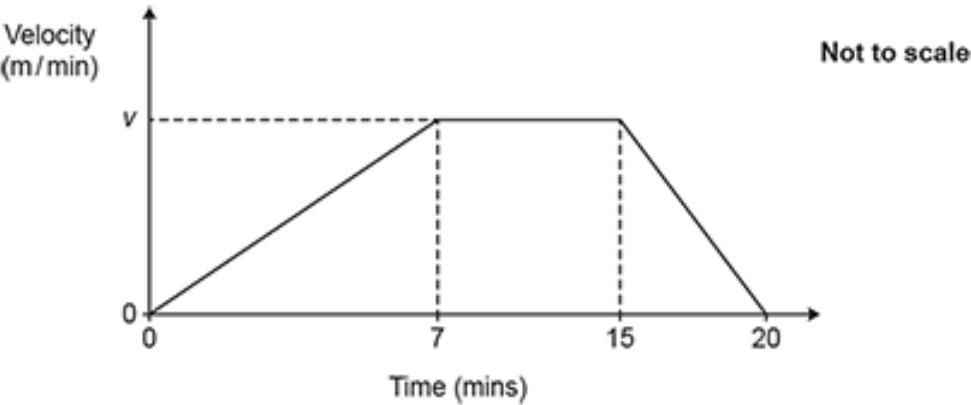


Write the letter of the graph that represents the following relationships.

y is directly proportional to x [1]

(b). y is inversely proportional to x [1]

67. The graph shows the velocity of a particle over the first 20 minutes of its motion.



Between 7 minutes and 15 minutes the velocity of the particle is v metres per minute.
The average velocity of the particle over the 20 minutes is 11.55 metres per minute.

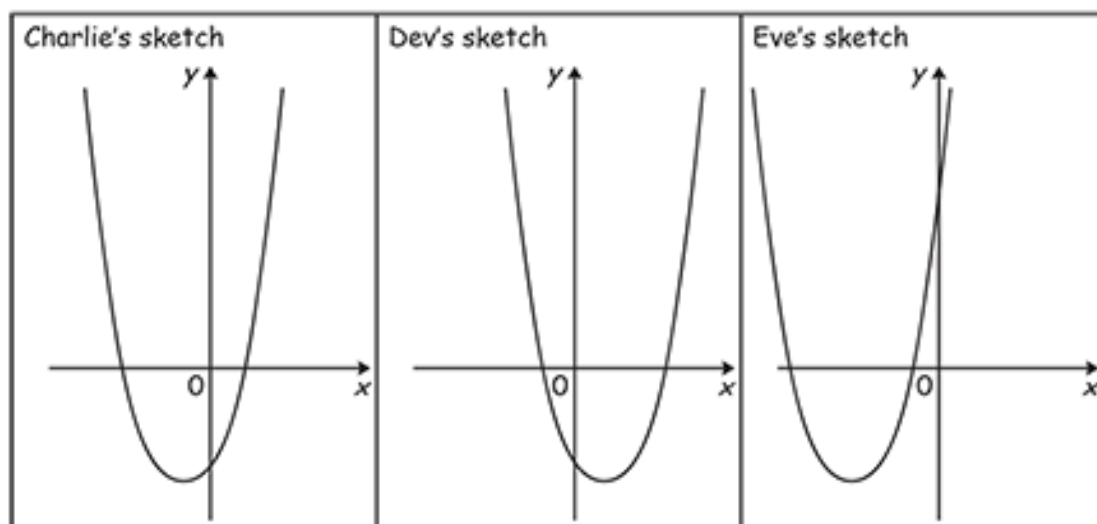
Find the value of v .
You must show your working.

$v = \dots\dots\dots$ [5]

68. Describe fully the graph of $x^2 + y^2 = 20$.

$\dots\dots\dots$ [3]

69. Charlie, Dev and Eve all attempt to sketch the graph of $y = (2x - 5)(x + 4)$.



Whose sketch is the most accurate?

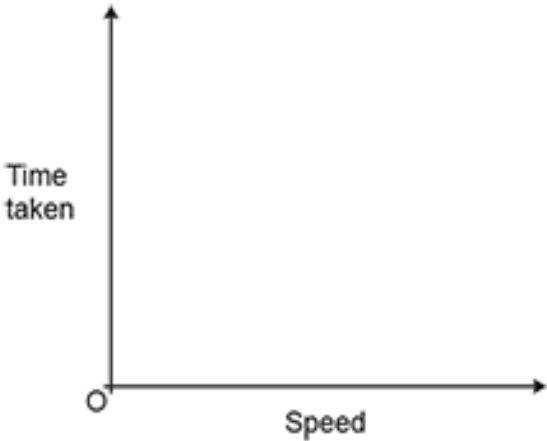
Write down the properties of the graph that you used in making your decision.

_____ because _____

.....[2]

70. The time taken to complete a journey halves as the speed doubles.

On the axes below, sketch a graph to show this relationship.



[2]

71. A rhombus is drawn on a coordinate grid.

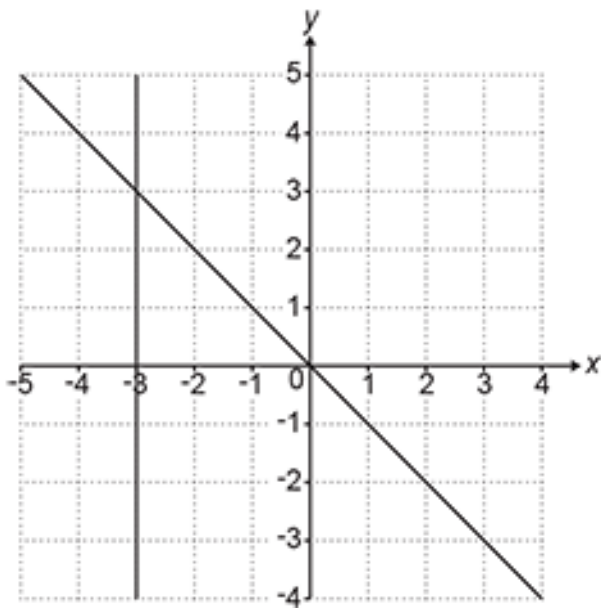
One diagonal of the rhombus has equation $y = \frac{1}{2}x + 3$.

The other diagonal passes through the point (1, 7).

Find the equation of the other diagonal of the rhombus.
Give your answer in the form $y = mx + c$.

$y = \dots\dots\dots$ [4]

72. The graphs of $x = -3$ and $y = -x$ are drawn on the grid.



The region **R** satisfies the following inequalities.

$x \leq -3$

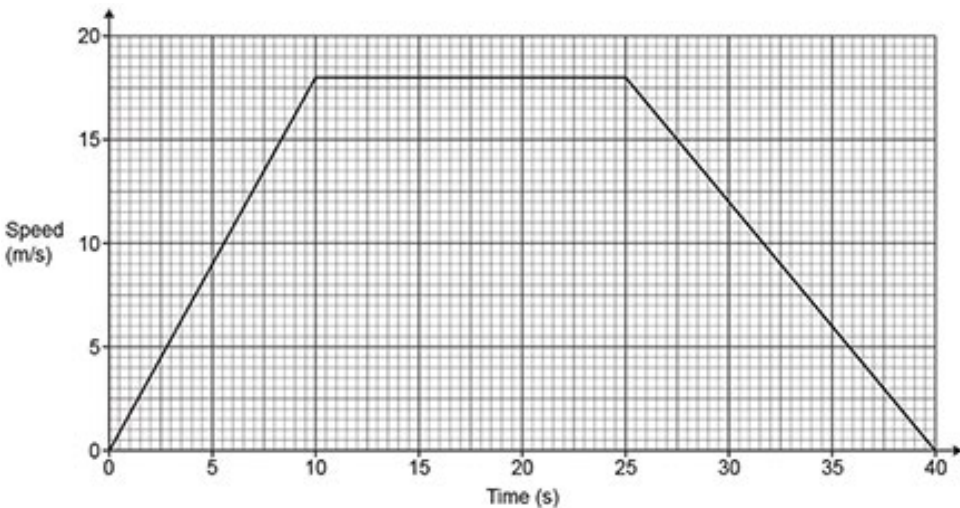
$y \leq -x$

$y - 1 > \frac{1}{2}x$

By drawing one more line, find and label the region **R**.

[5]

73(a). The graph shows the speed of a car during the first 40 seconds of a journey.



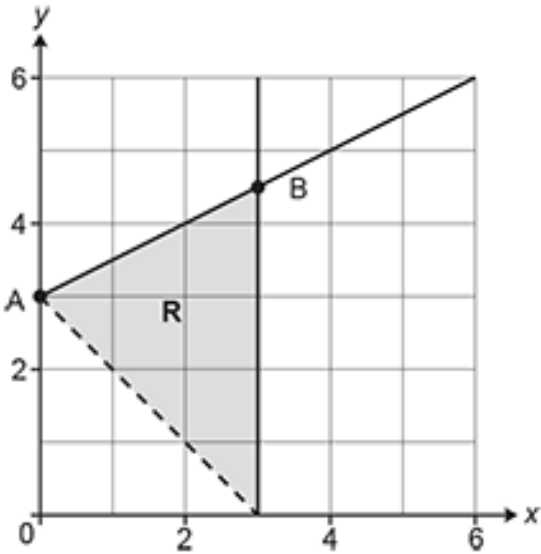
Write down the acceleration of the car between 10 seconds and 25 seconds.

..... m/s² [1]

(b). Work out the average speed of the car, in m/s, during the 40 seconds.
You must show your working.

..... m/s **[5]**

74(a). The region **R** is shown on this grid.
A is the point (0, 3) and B is the point (3, 4.5).



Show that an equation of the straight line through A and B is $2y = x + 6$.

[3]

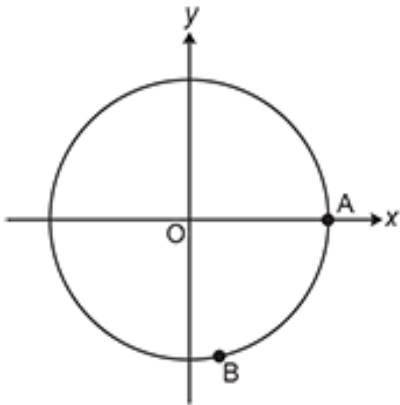
(b). Write down the three inequalities that define region R.

.....

.....

..... [5]

75(a). A circle has equation $x^2 + y^2 = 100$.
The sketch shows the circle and two points, A and B, which lie on the circumference of the circle.



Write down the coordinates of point A.

(..... ,) [1]

(b). Point B has x-coordinate 3.

Find the exact value of the y-coordinate of point B.

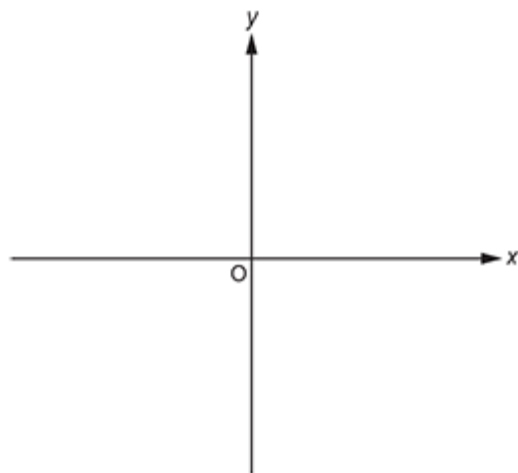
..... [3]

(c). Another point, C, lies on the circle and has a y-coordinate that is seven times its x-coordinate.

Find the two possible pairs of coordinates for point C.
Give your answers in exact form.
You must show your working.

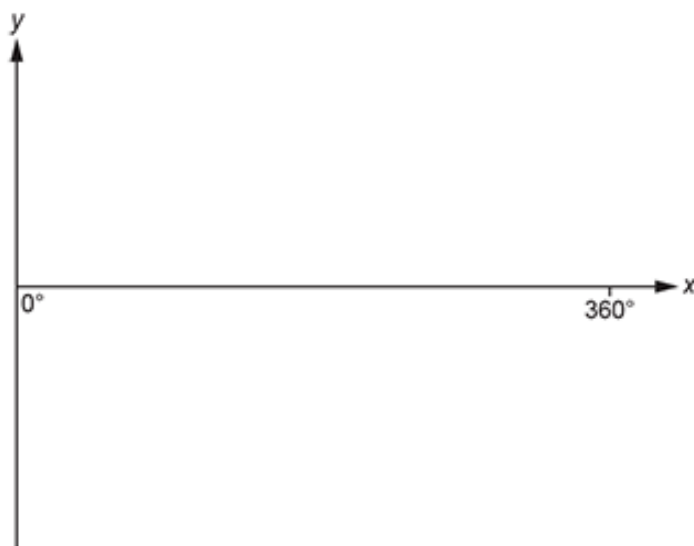
(..... ,) and (..... ,) [5]

76(a). Sketch the graph of $y = 5^x$ indicating any values where the graph crosses the axes.



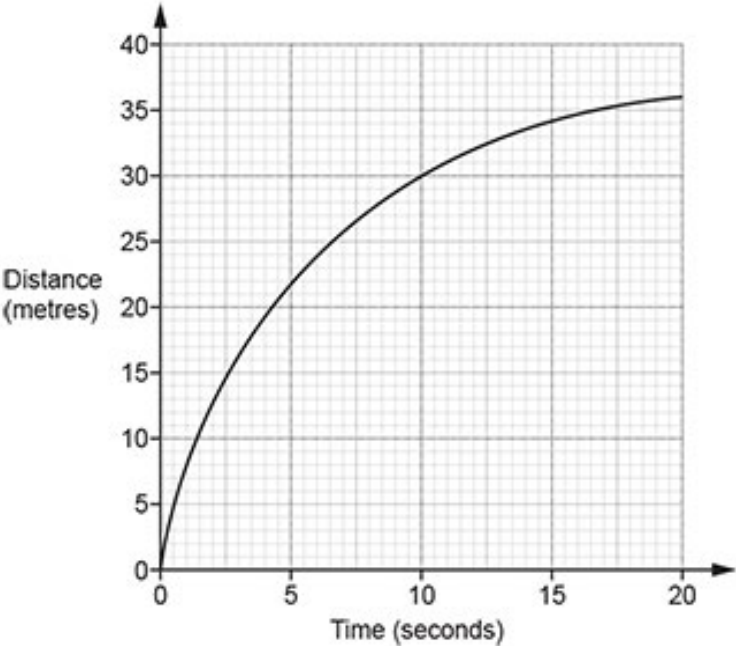
[2]

(b). Sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$ indicating any values where the graph crosses the axes.



[2]

77(a). The graph shows the distance travelled by a particle over the first 20 seconds of its motion.



Estimate the speed of the particle at 10 seconds.
You must show working to support your estimate.

..... m/s **[3]**

(b). Show that the average speed of the particle over the first 20 seconds of its motion is 1.8 m/s.

[1]

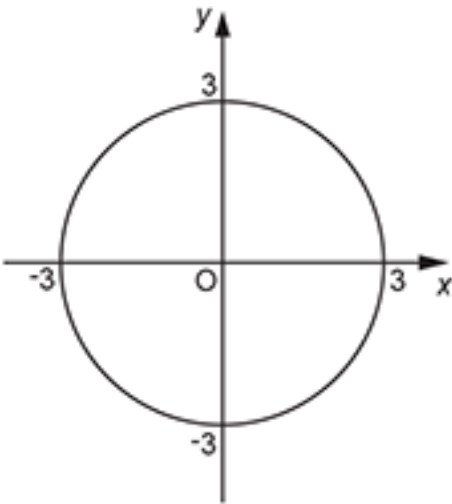
78. Find the equation of the line through (4, 5) that is perpendicular to $y = 2x - 3$.

..... [3]

79. Describe the **single** transformation that maps the graph of $y = x^2$ onto the graph of $y = (x + 3)^2 + 5$.

..... [3]

80. The diagram shows a circle, centre the origin.



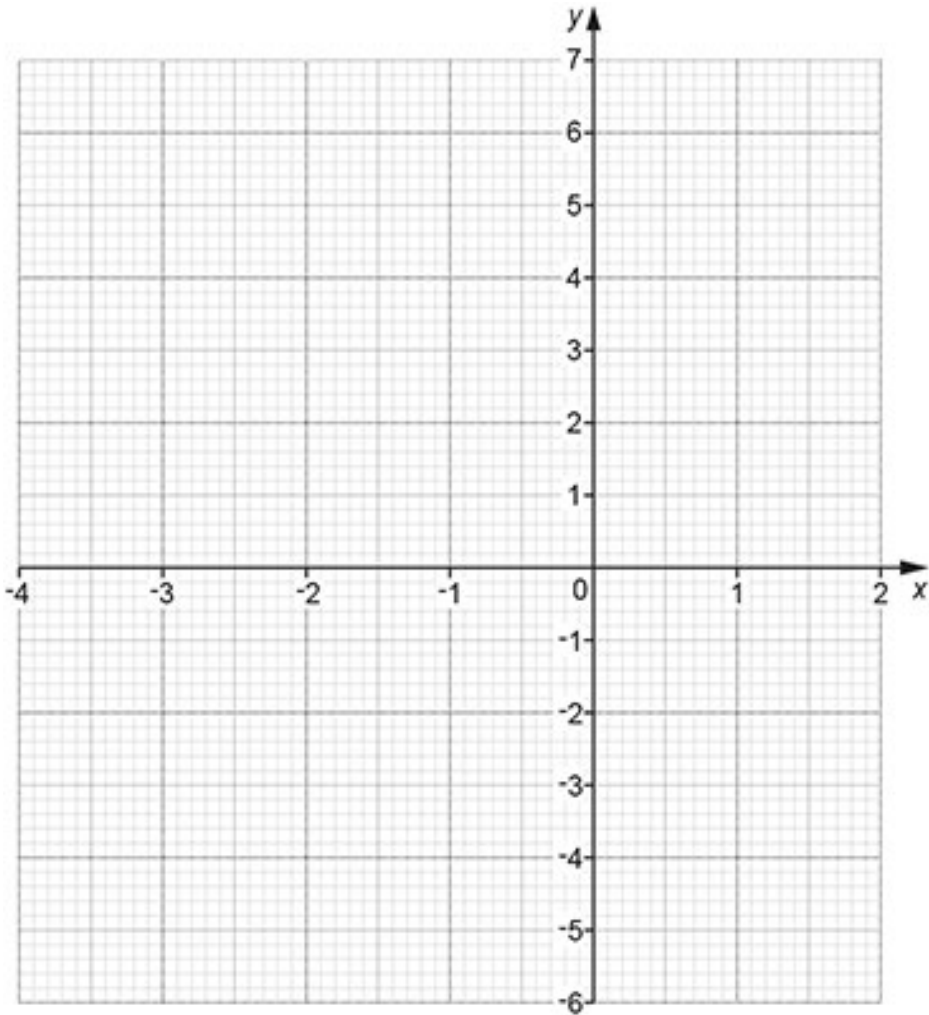
Write down the equation of the circle.

..... [2]

81(a). Here is a table of values for $y = x^2 + 2x - 2$.

x	-4	-3	-2	-1	0	1	2
y	6	1	-2	-3	-2	1	6

Draw the graph of $y = x^2 + 2x - 2$ for $-4 \leq x \leq 2$.



[3]

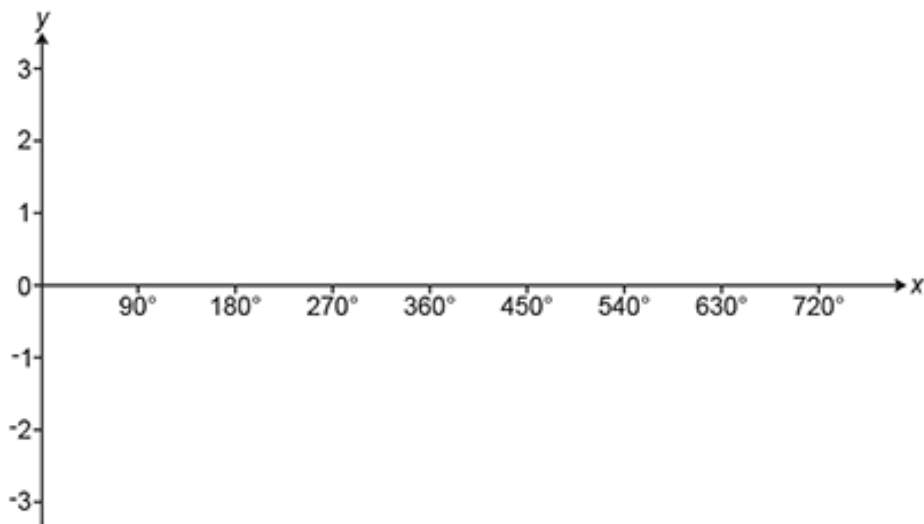
(b). Write down the equation of the line of symmetry of the graph.

..... [1]

(c). Use the graph to solve the equation $x^2 + 2x - 2 = 0$.
Give your answers to 1 decimal place.

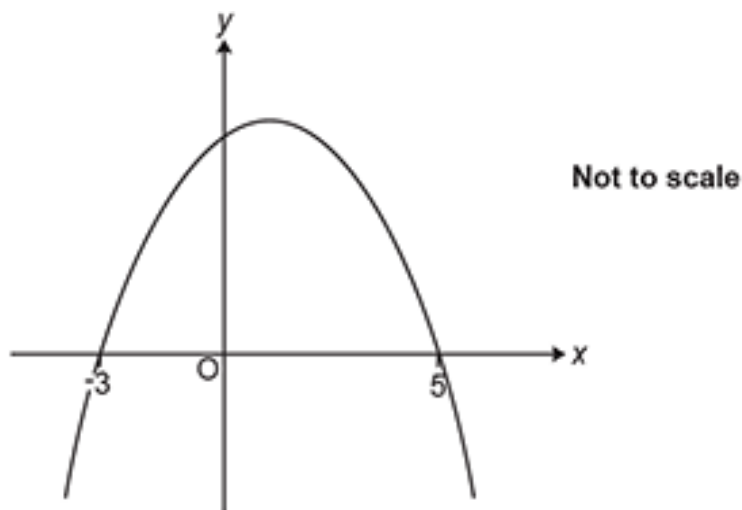
(c) $x =$ or $x =$ [2]

82. Sketch the graph of $y = \cos x - 1$ for $0^\circ \leq x \leq 720^\circ$.



[3]

83(a). Frankie sketches this quadratic graph.



Frankie says

The y -intercept is 15 .

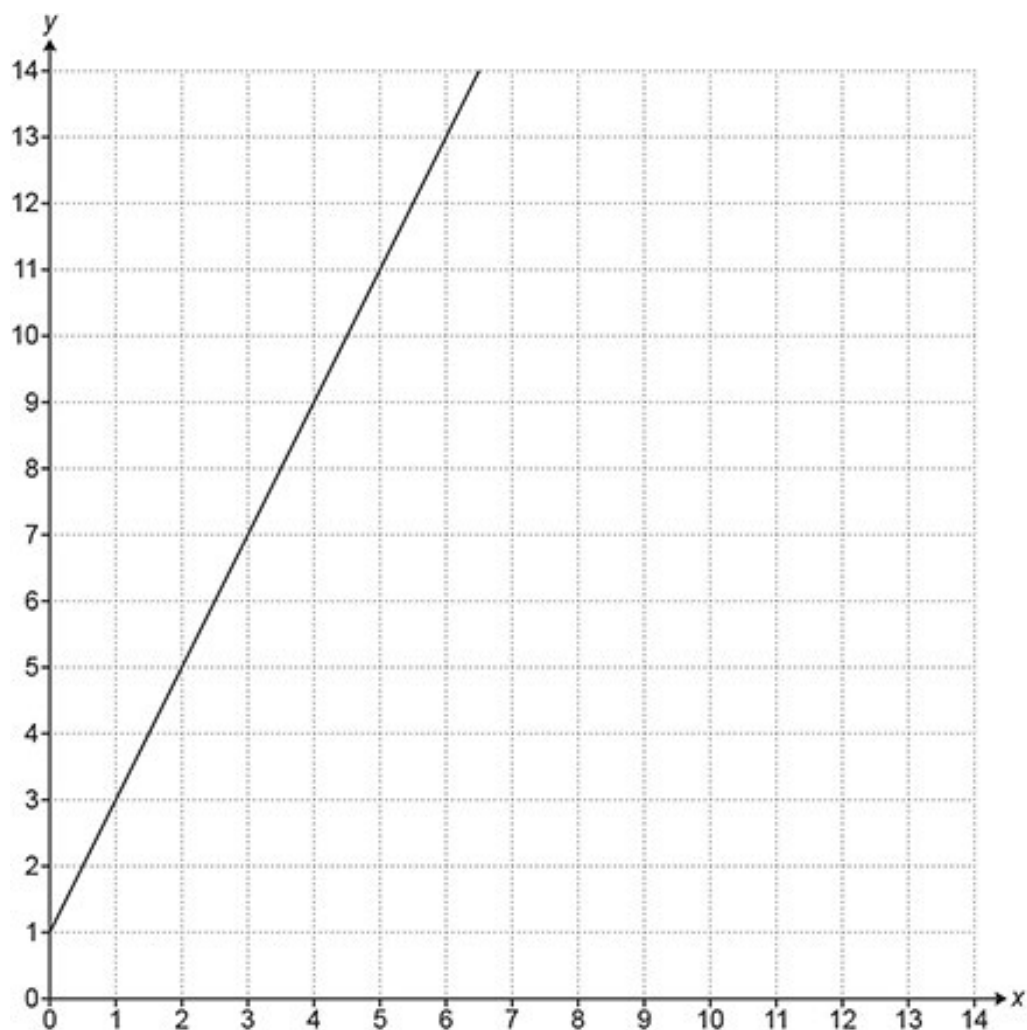
Show that what Frankie says could be correct.

[3]

(b). Explain why what Frankie says may **not** be correct.

[2]

84. The graph of $y = 2x + 1$ is drawn on this one centimetre grid.



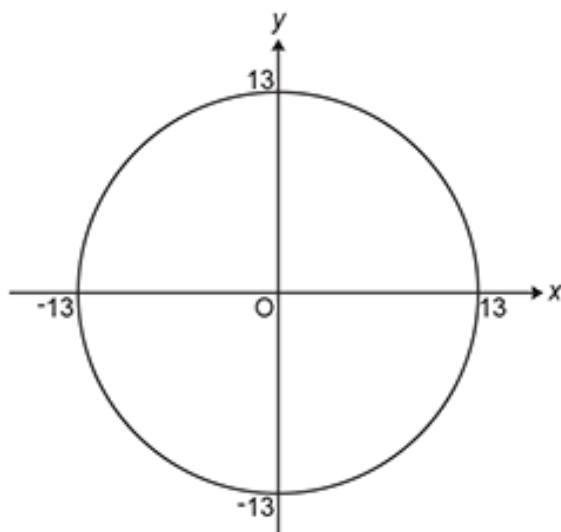
The region **R** satisfies these inequalities.

$$\begin{aligned}y &\leq 2x + 1 \\y &\geq 5 \\x + y &\leq 13\end{aligned}$$

Show that the area of region **R** is 12 cm^2 .

[6]

85(a). The graph below shows a circle with centre $(0, 0)$ and equation $x^2 + y^2 = 169$.



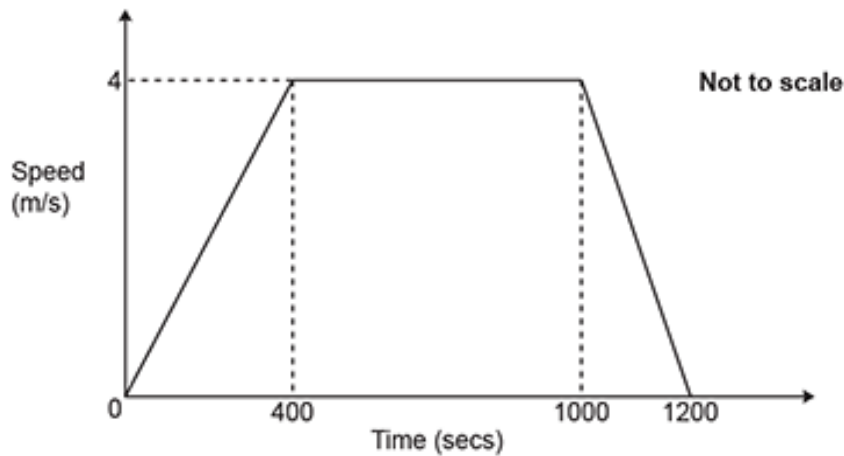
Show that the point $(-12, 5)$ lies on the circumference of the circle.

[2]

(b). Find the equation of the tangent to the circle at the point $(-12, 5)$, giving your answer in the form $y = mx + c$.

..... **[5]**

86. An athlete goes for a training run.
The graph shows their speed as they run.



Write down the athlete’s acceleration between 400 seconds and 1000 seconds.

..... m/s² **[1]**

87. A straight line passes through the point (8, 1) and is perpendicular to the line $y = 4x - 2$.

Find the equation of the line, giving your answer in the form $y = mx + c$.

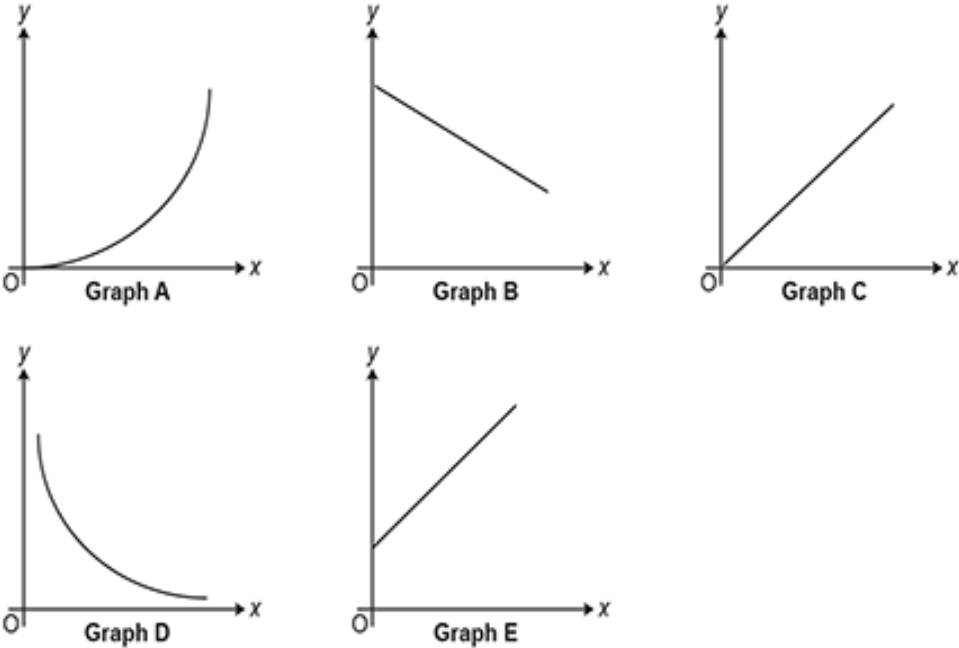
..... **[4]**

88. The point $(5, 7\sqrt{2})$ lies on the circumference of a circle, centre (0, 0).

Find the equation of the circle.

..... **[4]**

89(a). Here are sketches of five graphs.



Write the letter of the graph that represents the following relationships.

y is directly proportional to x .

..... s[1]

(b). y is inversely proportional to x .

..... [1]

90(a). For each graph below, select its possible equation from this list.

- $y = x$

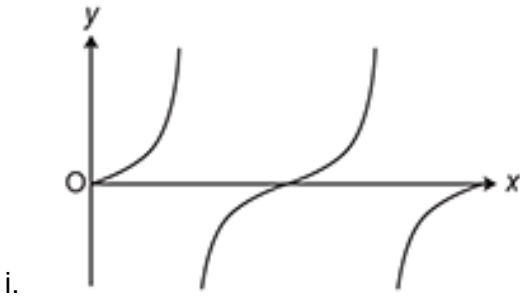
$y = \sin x$

$y = 3^x$
- $y = x^2$

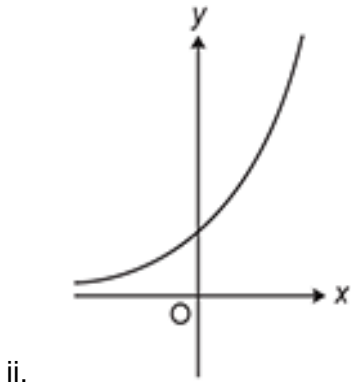
$y = \cos x$

$y = \left(\frac{1}{3}\right)^x$
- $y = \frac{1}{x}$

$y = \tan x$

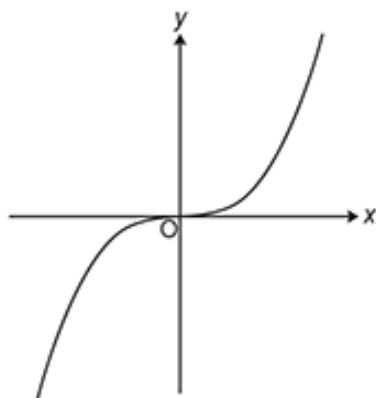


(i) $y = \dots\dots\dots$ **[1]**



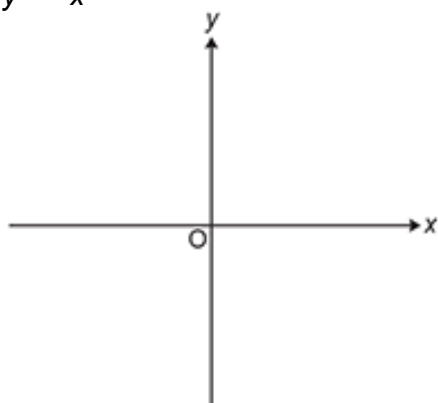
(ii) $y = \dots\dots\dots$ **[1]**

(b). Here is a sketch of $y = x^3$.



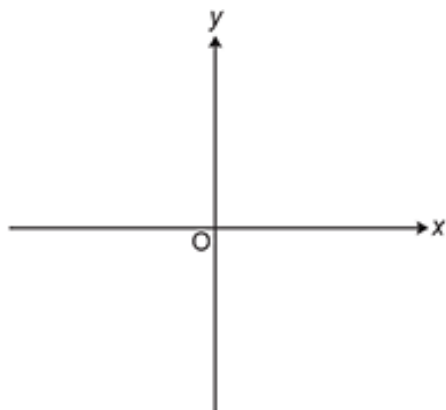
On the axes below, sketch the graphs of

i. $y = -x^3$



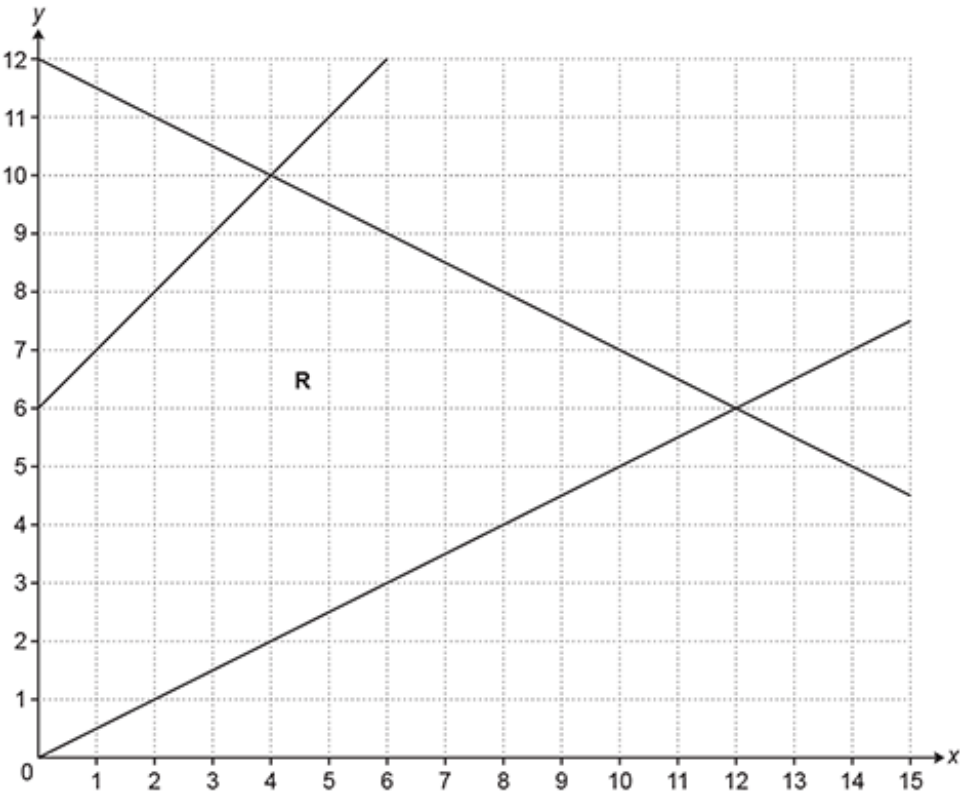
[1]

ii. $y = x^3 - 8$, showing the values of any intercepts with the axes.



[3]

91(a). The region **R** is shown on this grid.



Region **R** is defined by four inequalities.
One of the inequalities is $x \geq 0$.
Use the symbols $\leq$ and $\geq$ to complete the other three inequalities.

$x \geq 0$

$y \leq \frac{1}{2}x$

$x + 2y \leq 24$

$y \leq x + 6$

[2]

(b). The inequality $x \geq 0$ is replaced by a new inequality.
Region **R** is then a kite.

Write down the new inequality.

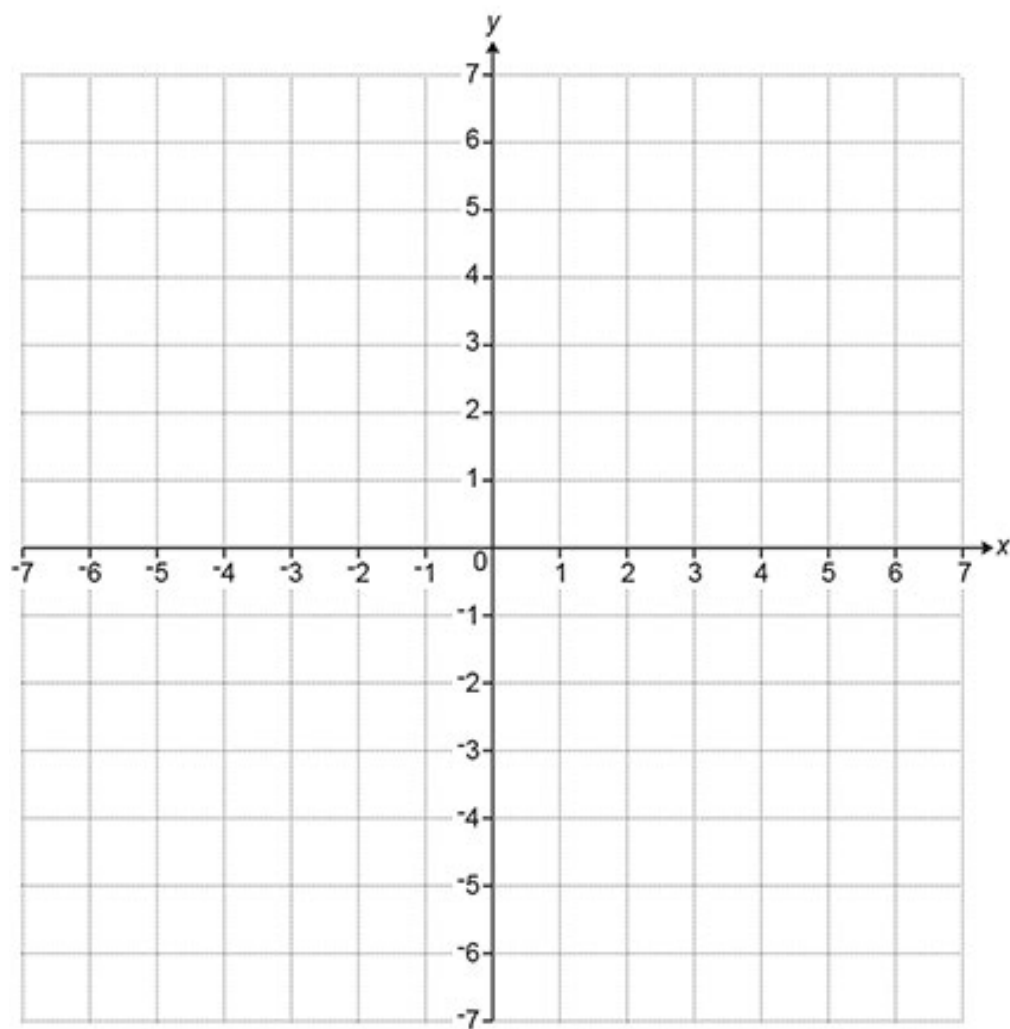
..... [3]

92(a). Complete the table for $y = \frac{6}{x}$

x	-6	-3	-2	-1	1	2	3	6
y	-1	-2		-6	6	3	2	1

[1]

(b). Draw the graph of $y = \frac{6}{x}$ for $-6 \leq x \leq 6$, $x \neq 0$.



[3]

93. Find the coordinates of the turning point of the graph of $y = x^2 + 6x + 17$.

(..... ,)**[4]**

END OF QUESTION PAPER