

## OCR 07 Graphs of Equations and Functions (Higher)

1. A graph has the equation  $y = x^2 + 6x - 16$ .  
Find the coordinates of the points where the line intercepts the  $x$ -axis.
2. Find the equation of a line perpendicular to the line  $y = 4x + 6$ .
3. The graph of  $y = x^2$  is translated 3 units up.  
What is the equation of the transformed graph?
4. Which of the following lines are parallel to each other?

A:  $2y + 3x = 7$

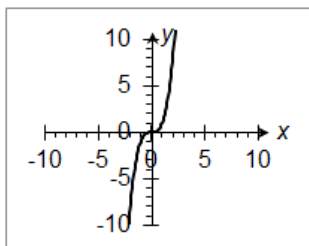
B:  $y = 6x + 5$

C:  $2y = 3x + 3$

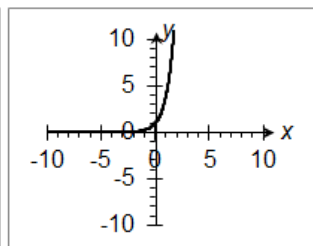
D:  $y = 10 - 6x$

E:  $2y = 12x + 4$

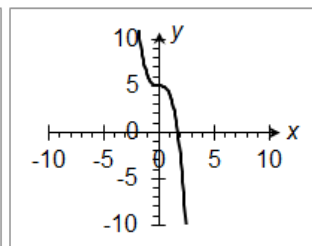
5. Which graph below shows the equation  $y = 4^x$ ?



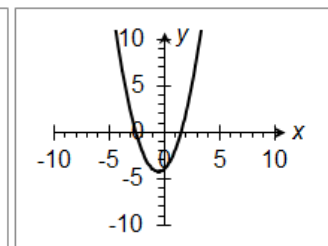
Graph 1



Graph 2



Graph 3



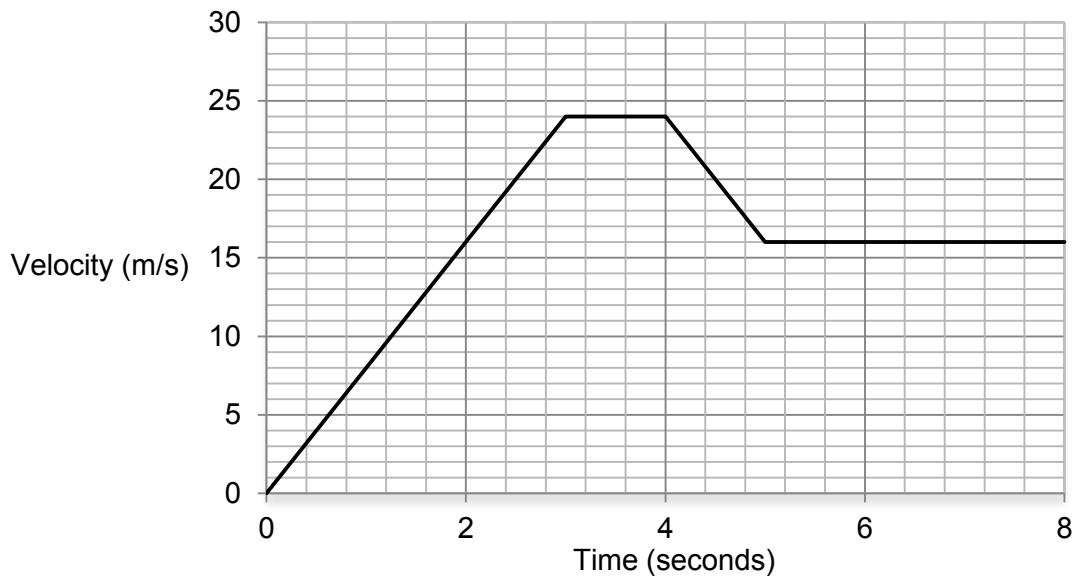
Graph 4

6. Find the equation of the line that is perpendicular to  $y = 4 - 0.5x$  and that intersects it at the point where  $x = 6$ .
7. Find the turning point of the graph  $y = x^2 + 10x + 9$  by completing the square.

# MATHEMATICS

## Section Check In

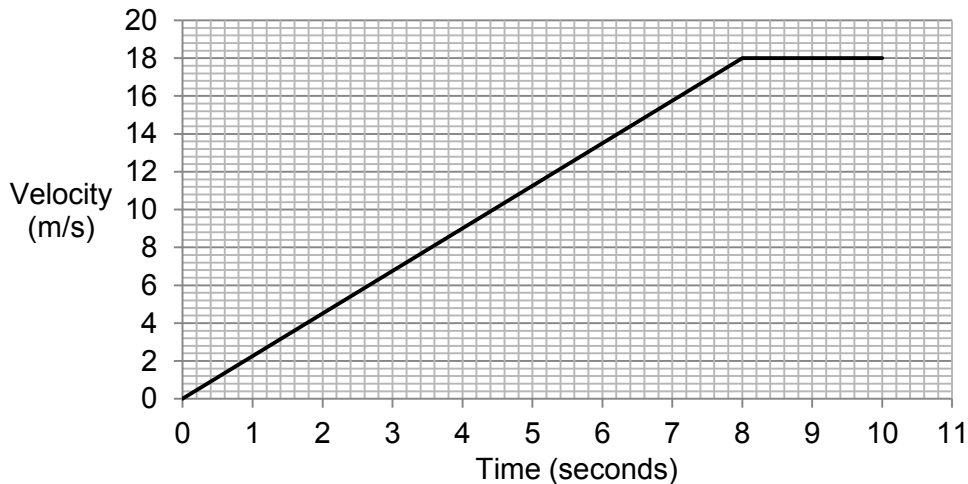
8. Use the velocity-time graph below to calculate the distance travelled during the 8 seconds.



9. Complete the table below of values for  $y = 5 \times 2^x$  and use this table to plot the graph.

|     |    |     |   |    |   |    |   |
|-----|----|-----|---|----|---|----|---|
| $x$ | -2 | -1  | 0 | 1  | 2 | 3  | 4 |
| $y$ |    | 2.5 |   | 10 |   | 40 |   |

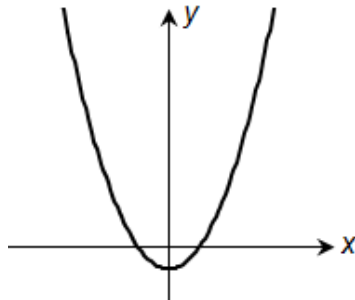
10. Use the graph below to calculate the acceleration in the first 8 seconds.



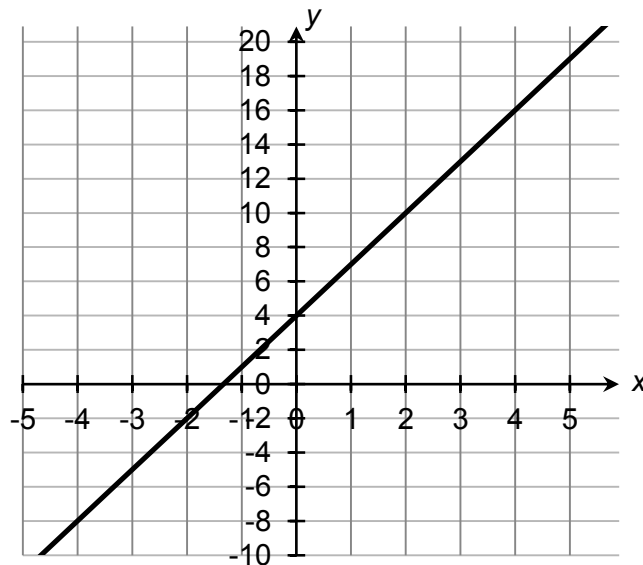
11. A circle with centre at the origin has a radius of 6 cm. Jenny is asked to find the equation of the circle. Her answer is  $x^2 + y^2 = 6$ . Is she correct? Explain your answer.

12. The graph  $y = x^2$  is transformed to the graph  $y = -x^2$ . Dexter says the transformation is a reflection in the line  $x = 0$ . Is he correct? Explain your answer.

13. Tilly says that the sketch below shows  $y = x^2 + 1$ . Is she correct? Explain your answer.



14. Bradley is asked to find the gradient of a line perpendicular to the one shown in the graph below. His answer is  $-3$ . Is he correct? Explain your answer.



15. Point A is  $(-2, 6)$ , point B is  $(0, 4)$  and point C is  $(1, -2)$ .  
Do all 3 points satisfy the inequality  $y > x^2 - 3$ ?

16. The straight line  $3y - 6x = 15$  goes through the points  $(a, 13)$  and  $\left(\frac{3}{a^2}, b\right)$ .

Find the values of  $a$  and  $b$ .

17. The straight line  $y = x + 3$  crosses the circle  $x^2 + y^2 = 17$  at two points.  
Find the coordinates of these two points.

18. The graph of  $y = x^2 + bx + c$  has a turning point at  $(2, 3)$ .  
Calculate the values of  $b$  and  $c$ .

19. A straight line is drawn from  $(3, 2)$  to  $(7, 14)$ . Find the equation of the perpendicular bisector of this line.

20. A car accelerates at a constant rate from rest, reaching a velocity of  $12 \text{ m/s}$  after  $10$  seconds. It then travels at a constant velocity for a further  $20$  seconds. Calculate the distance travelled during the  $30$  seconds.

# MATHEMATICS

## Section Check In

### Answers

1. (2, 0) and (-8, 0)

2.  $y = -\frac{1}{4}x(+c)$

3.  $y = x^2 + 3$

4. B and E

5. Graph 2

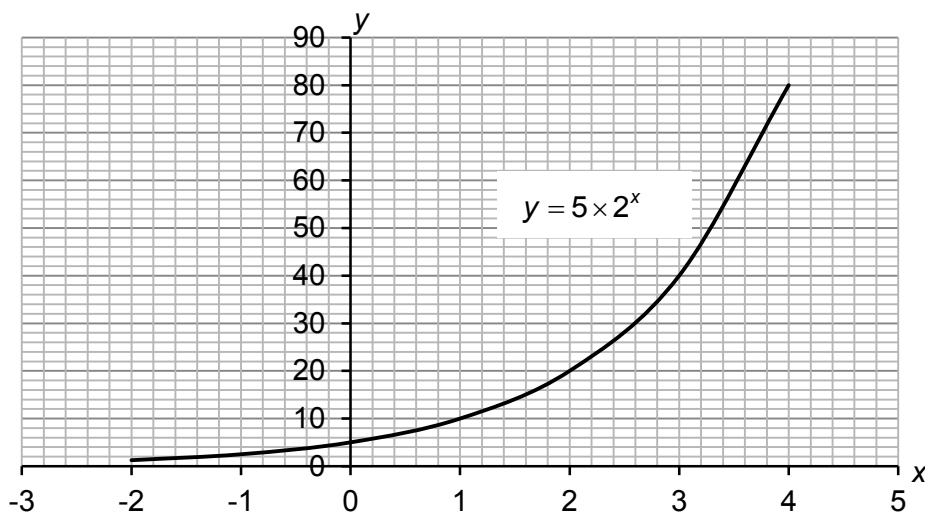
6. Point of intersection is (6, 1). Equation is  $y = 2x - 11$ .

7.  $y = (x + 5)^2 - 25 + 9$ ,  $y = (x + 5)^2 - 16$ , turning point = (-5, -16).

8. Area under graph = distance travelled = 128 metres.

9.

|   |      |     |   |    |    |    |    |
|---|------|-----|---|----|----|----|----|
| x | -2   | -1  | 0 | 1  | 2  | 3  | 4  |
| y | 1.25 | 2.5 | 5 | 10 | 20 | 40 | 80 |

10. Acceleration = gradient =  $18 \div 8 = 2.25 \text{ m/s}^2$ .11. Jenny is not correct as the equation is  $x^2 + y^2 = r^2$  so therefore  $x^2 + y^2 = 36$ .12. Dexter is not correct. The transformation is a reflection in the line  $y = 0$ .13. Tilly is not correct as the y-axis intercept is negative and  $y = x^2 + 1$  only has positive y-values.

14. The gradient of the line shown is 3. The product of the gradients of two perpendicular lines equals  $-1$ , so Bradley is not correct as  $3 \times -3 = -9$ . The gradient of a line perpendicular to the one shown would be  $-\frac{1}{3}$ .

15. Point A satisfies the inequality as  $6 > 1$ .

Point B satisfies the inequality as  $4 > -3$

Point C does not satisfy the inequality as  $-2$  is not greater than  $-2$ ; it is equal to it.

16. At  $(a, 13)$ :

$$3 \times 13 - 6a = 15$$

$$6a = 24$$

$$a = 4$$

$$\left( a^{\frac{3}{2}}, b \right) = (8, b)$$

At  $(8, b)$ :

$$3b - 6 \times 8 = 15$$

$$3b = 63$$

$$b = 21$$

17.  $x^2 + (x + 3)^2 = 17$

$$2x^2 + 6x - 8 = 0$$

$$(x - 1)(x + 4) = 0$$

$$x = 1 \text{ and } x = -4$$

When  $x = 1$ ,  $y = 4$

When  $x = -4$ ,  $y = -1$

18.  $y = (x - 2)^2 + 3$

$$y = x^2 - 4x + 7$$

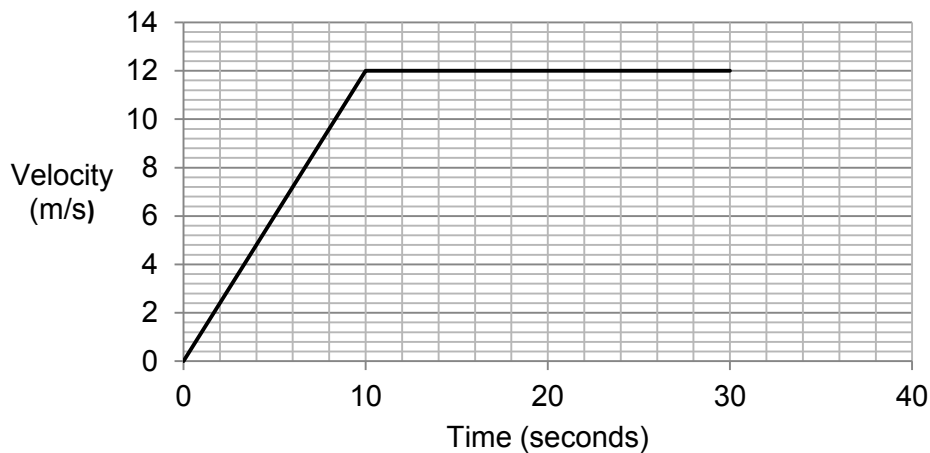
$$b = -4 \text{ and } c = 7$$

19. Gradient of line joining two points  $= \frac{14 - 2}{7 - 3} = 3$  so gradient of perpendicular bisector  $= -\frac{1}{3}$ .

The midpoint is  $(5, 8)$ .

The equation is  $y = -\frac{1}{3}x + 9\frac{2}{3}$  or  $3y + x = 29$ .

20. The distance travelled is the area under the graph.



Area under graph in first 10 seconds =  $5 \times 12 = 60$

Area under graph between 10 and 30 seconds =  $20 \times 12 = 240$

Distance travelled =  $60 + 240 = 300$  metres

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| Assessment Objective | Qu. | Topic  | R | A | G |
|----------------------|-----|--|---|---|---|
| AO1                  | 1   | Identify intercepts of a quadratic graph                             |   |   |   |
| AO1                  | 2   | Find the equation of a perpendicular line                            |   |   |   |
| AO1                  | 3   | Identify a translation of a given graph                              |   |   |   |
| AO1                  | 4   | Identify equations of parallel lines                                 |   |   |   |
| AO1                  | 5   | Recognise the graph of an exponential function                       |   |   |   |
| AO1                  | 6   | Find an equation of a perpendicular line                             |   |   |   |
| AO1                  | 7   | Identify the turning point by completing the square                  |   |   |   |
| AO1                  | 8   | Calculate the area under a graph                                     |   |   |   |
| AO1                  | 9   | Use a table of values to plot an exponential graph                   |   |   |   |
| AO1                  | 10  | Calculate acceleration from a velocity-time graph                    |   |   |   |
| AO2                  | 11  | Recognise and use the equation of a circle with centre at the origin |   |   |   |
| AO2                  | 12  | Identify a reflection of a given graph                               |   |   |   |
| AO2                  | 13  | Recognise properties of a quadratic graph                            |   |   |   |
| AO2                  | 14  | Calculate the gradient of a perpendicular line                       |   |   |   |
| AO2                  | 15  | Identify solutions of linear inequalities in two variables           |   |   |   |
| AO3                  | 16  | Identify points on a straight line with algebra                      |   |   |   |
| AO3                  | 17  | Solve a problem involving a straight line and a circle               |   |   |   |
| AO3                  | 18  | Use a turning point to solve a problem                               |   |   |   |
| AO3                  | 19  | Find the equation of a perpendicular bisector                        |   |   |   |
| AO3                  | 20  | Solve a problem involving a velocity-time graph                      |   |   |   |

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