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.

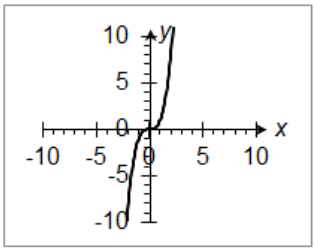
2. Find the equation of a line perpendicular to the line $y = 4x + 6$.

3. The graph of $y = x^2$ is translated 3 units up.
   What is the equation of the transformed graph?

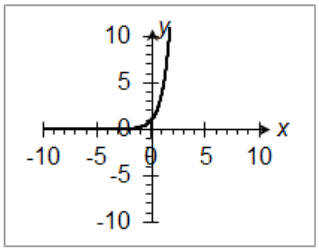
4. Which of the following lines are parallel to each other?

   A: $2y + 3x = 7$
   B: $y = 6x + 5$
   C: $2y = 3x + 3$
   D: $y = 10 - 6x$
   E: $2y = 12x + 4$

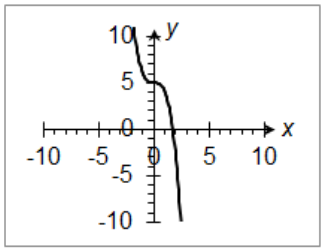
5. Which graph below shows the equation $y = 4^x$?



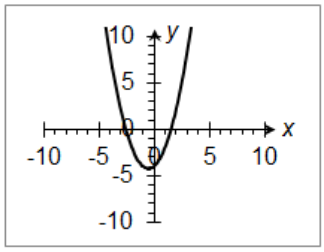
Graph 1



Graph 2



Graph 3

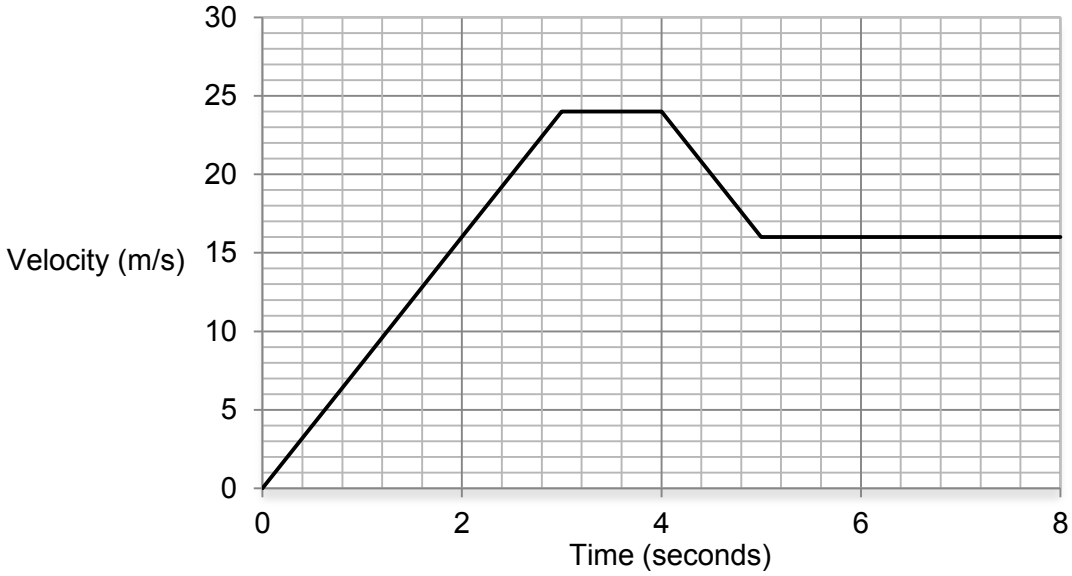


Graph 4

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.

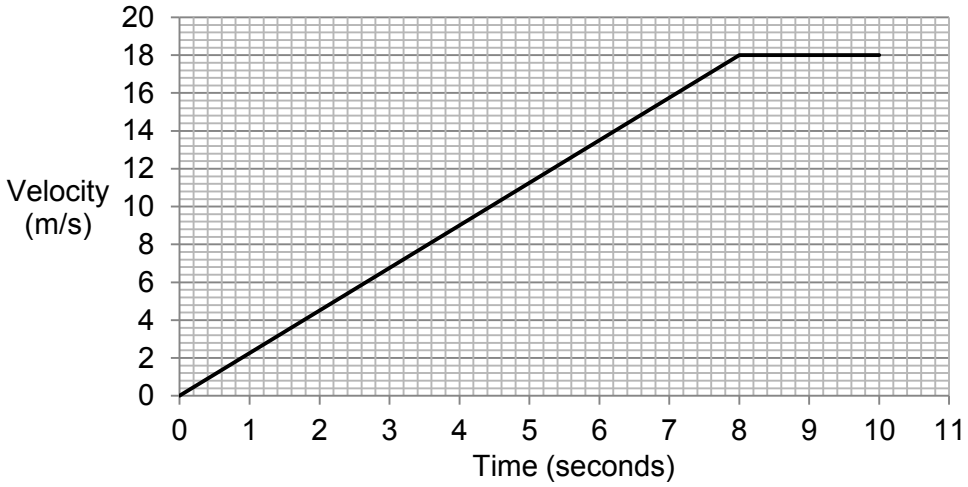
8. Use the velocity-time graph below to calculate the distance travelled during the 8 seconds.



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	

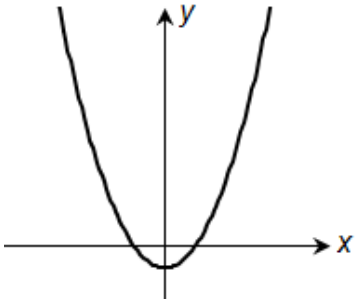
10. Use the graph below to calculate the acceleration in the first 8 seconds.



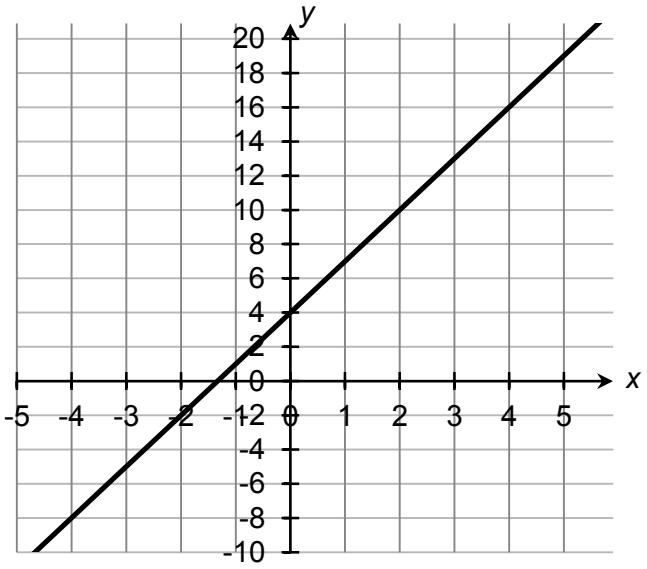
11. A circle with centre at the origin has a radius of 6 cm. Jenny is asked to find the equation of the circle. Her answer is $x^2 + y^2 = 6$. Is she correct? Explain your answer.

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

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 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.

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

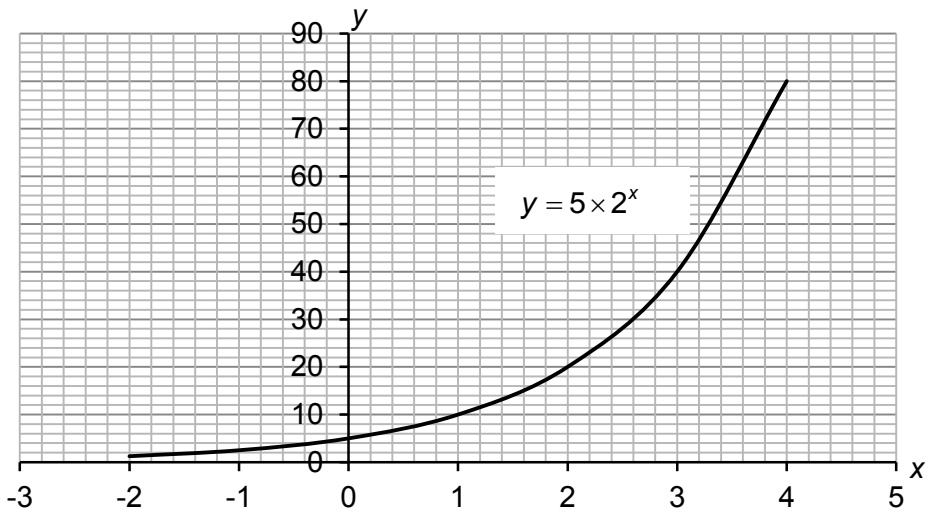
6. Point of intersection is (6, 1). Equation is $y = 2x - 11$.

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 $= 18 \div 8 = 2.25$ m/s².

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 $(8, b)$:
$3b - 6 \times 8 = 15$
$3b = 63$
$b = 21$

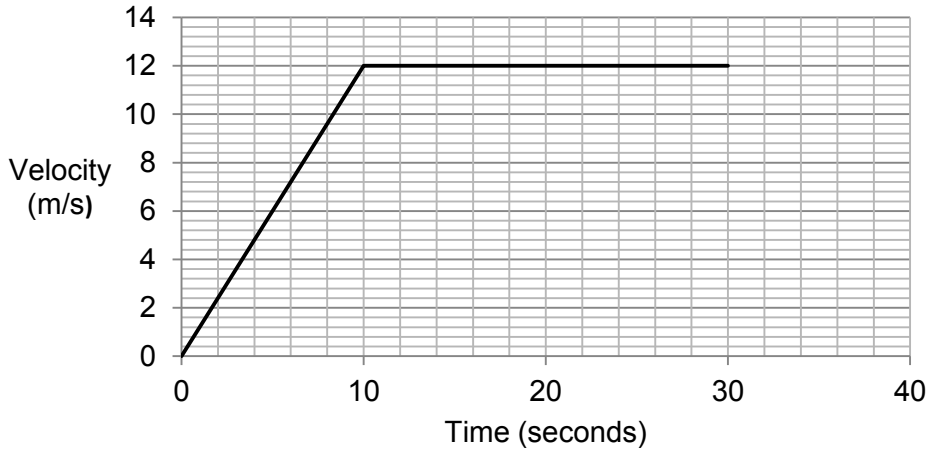
17. $x^2 + (x+3)^2 = 17$
$2x^2 + 6x - 8 = 0$
$(x-1)(x+4) = 0$
$x = 1$ and $x = -4$

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

18. $y = (x-2)^2 + 3$
$y = x^2 - 4x + 7$
$b = -4$ 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

GCSE (9–1)

MATHEMATICS

Section Check In

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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