Name: _____

Higher Unit 19 topic test

Date:

Time: 50 minutes

Total marks available: 43

Total marks achieved: _____

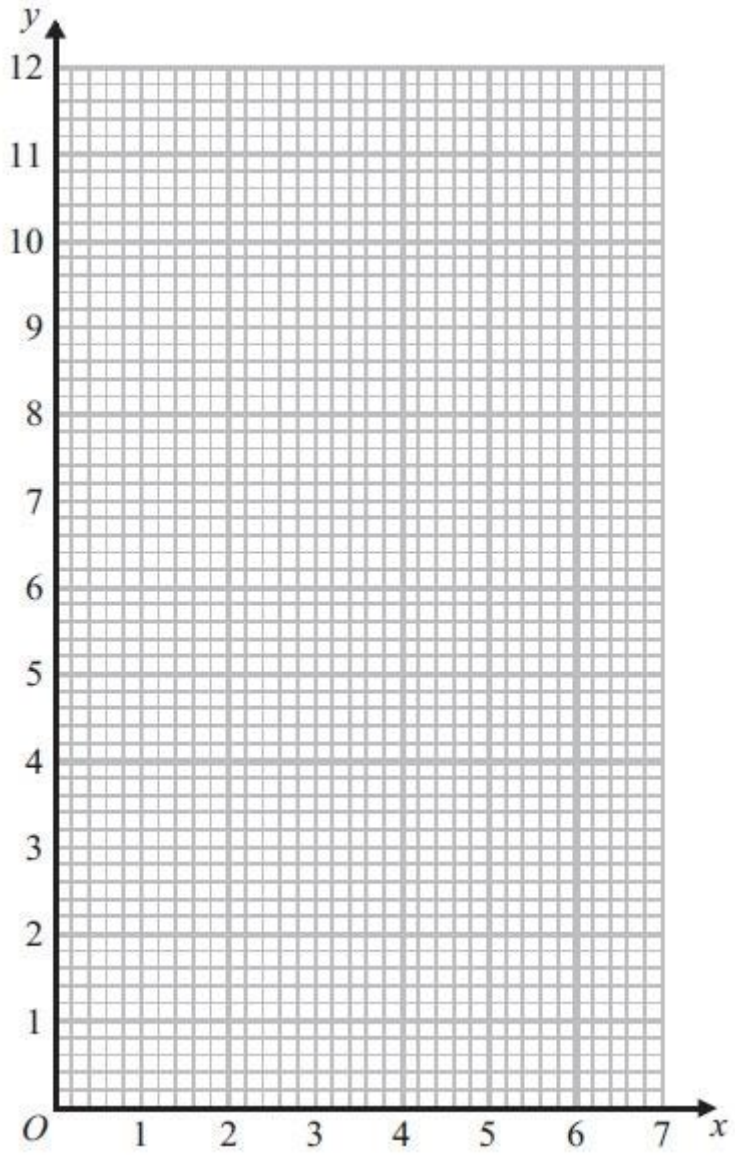
Questions

Q1.

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

x	0.5	1	2	3	4	5	6
y		6	3		1.5		1

(2)



(b) On the grid, draw the graph of $y = \frac{6}{x}$ for $0.5 \leq x \leq 6$

(2)

(Total for Question is 4 marks)

Q2.

The graph of $y = f(x)$ is transformed to give the graph of $y = -f(x + 3)$
The point A on the graph of $y = f(x)$ is mapped to the point P on the graph of $y = -f(x + 3)$

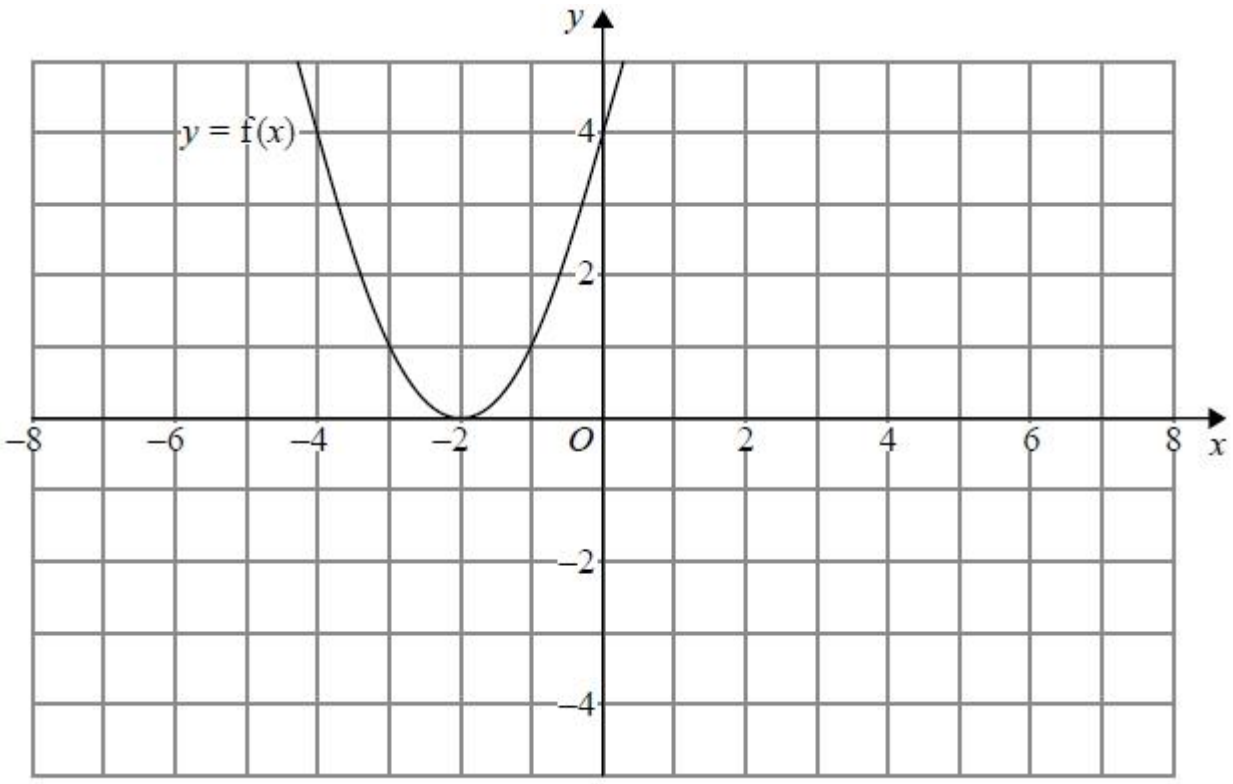
The coordinates of point A are (9, 1)
Find the coordinates of point P.

(..... , ...)

(Total for question is 2 marks)

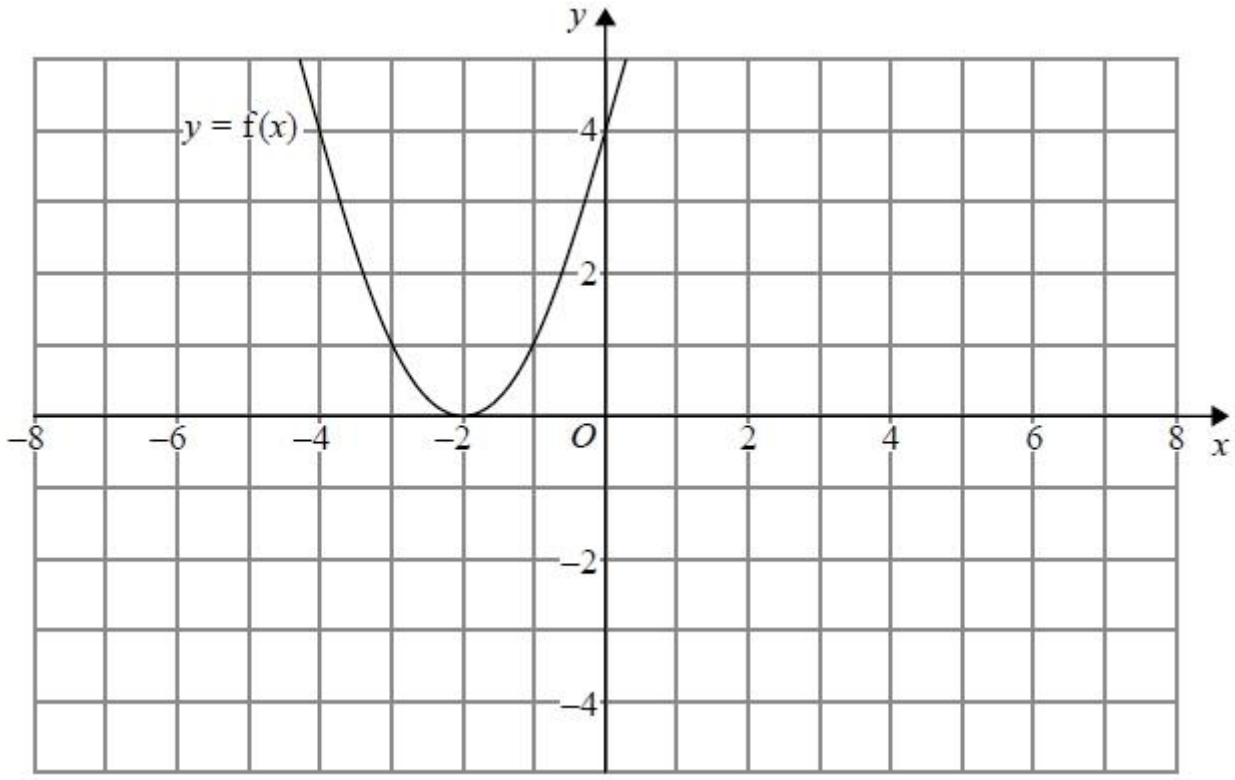
Q3.

The graph of $y = f(x)$ is shown on both grids below.



(a) On the grid above, sketch the graph of $y = f(-x)$

(1)



(b) On this grid, sketch the graph of $y = -f(x) + 3$

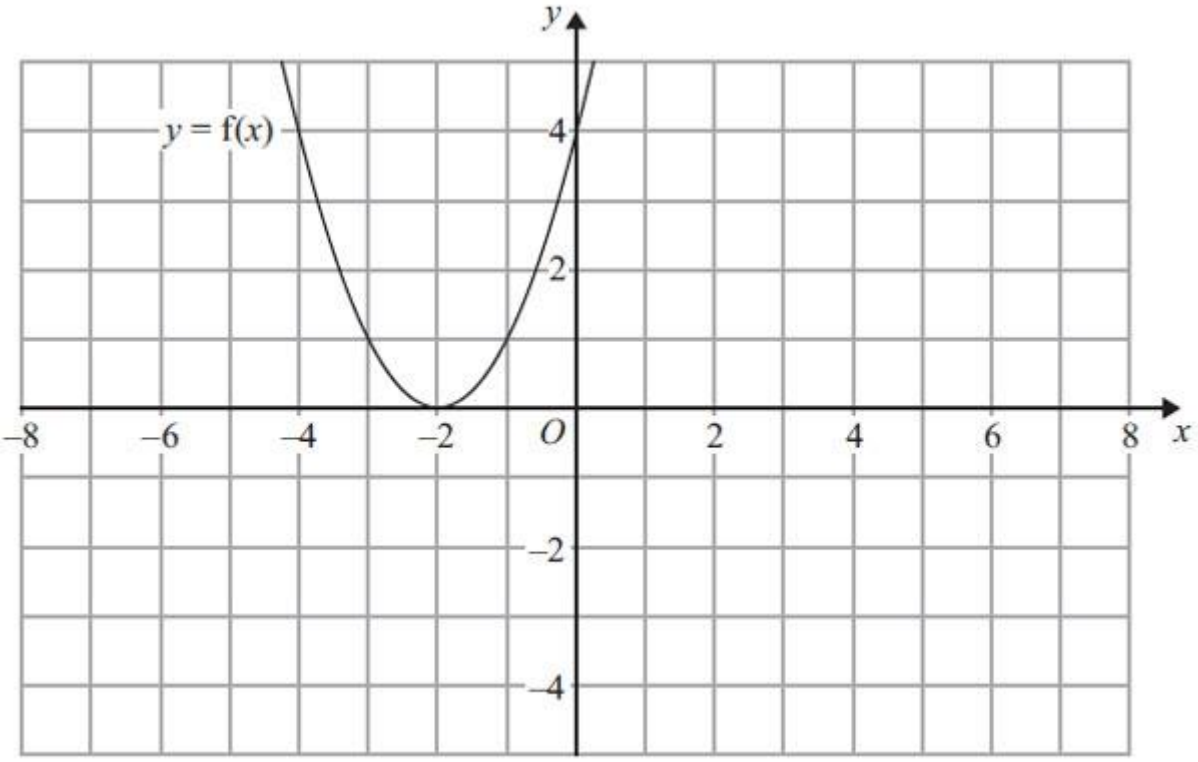
(1)

(Total for question = 2 marks)

Q4.

$y = f(x)$

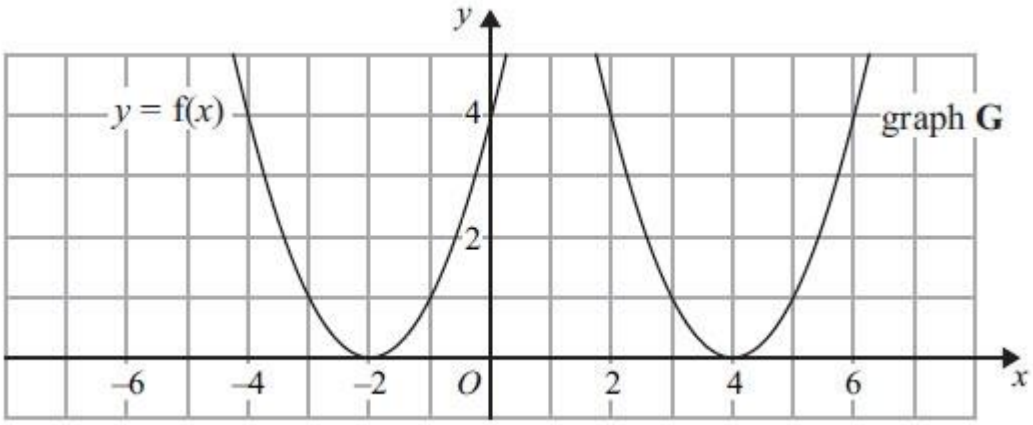
The graph of $y = f(x)$ is shown on the grid.



(a) On the grid above, sketch the graph of $y = – f(x)$.

(2)

The graph of $y = f(x)$ is shown on the grid.



The graph **G** is a translation of the graph of $y = f(x)$.

(b) Write down the equation of graph **G**.

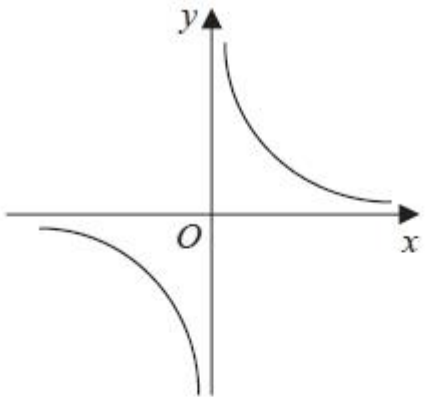
.....

(2)

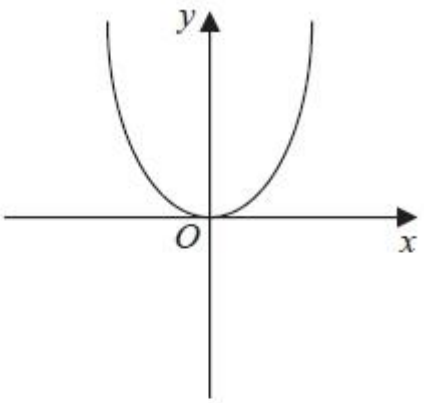
(Total for Question is 3 marks)

Q5.

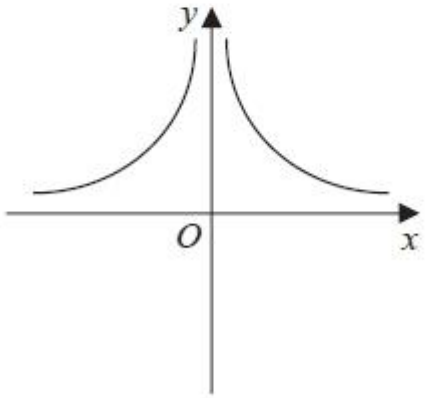
These graphs show four different proportionality relationships between *y* and *x*.



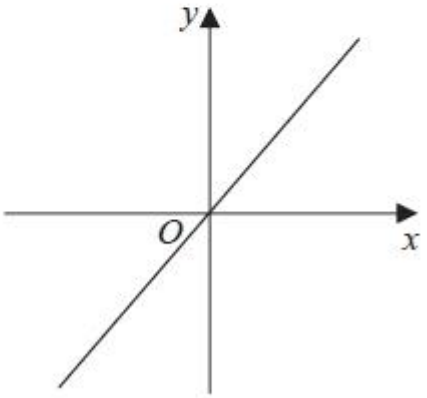
Graph A



Graph B



Graph C



Graph D

Match each graph with a statement in the table below.

Proportionality relationship	**Graph letter**
y is directly proportional to *x*	
y is inversely proportional to *x*	
y is proportional to the square of *x*	
y is inversely proportional to the square of *x*	

(Total for question is 2 marks)

Q6.

d is inversely proportional to c

When $c = 280$, $d = 25$

Find the value of d when $c = 350$

d = ...

(Total for question = 3 marks)

Q7.

T is inversely proportional to d^2

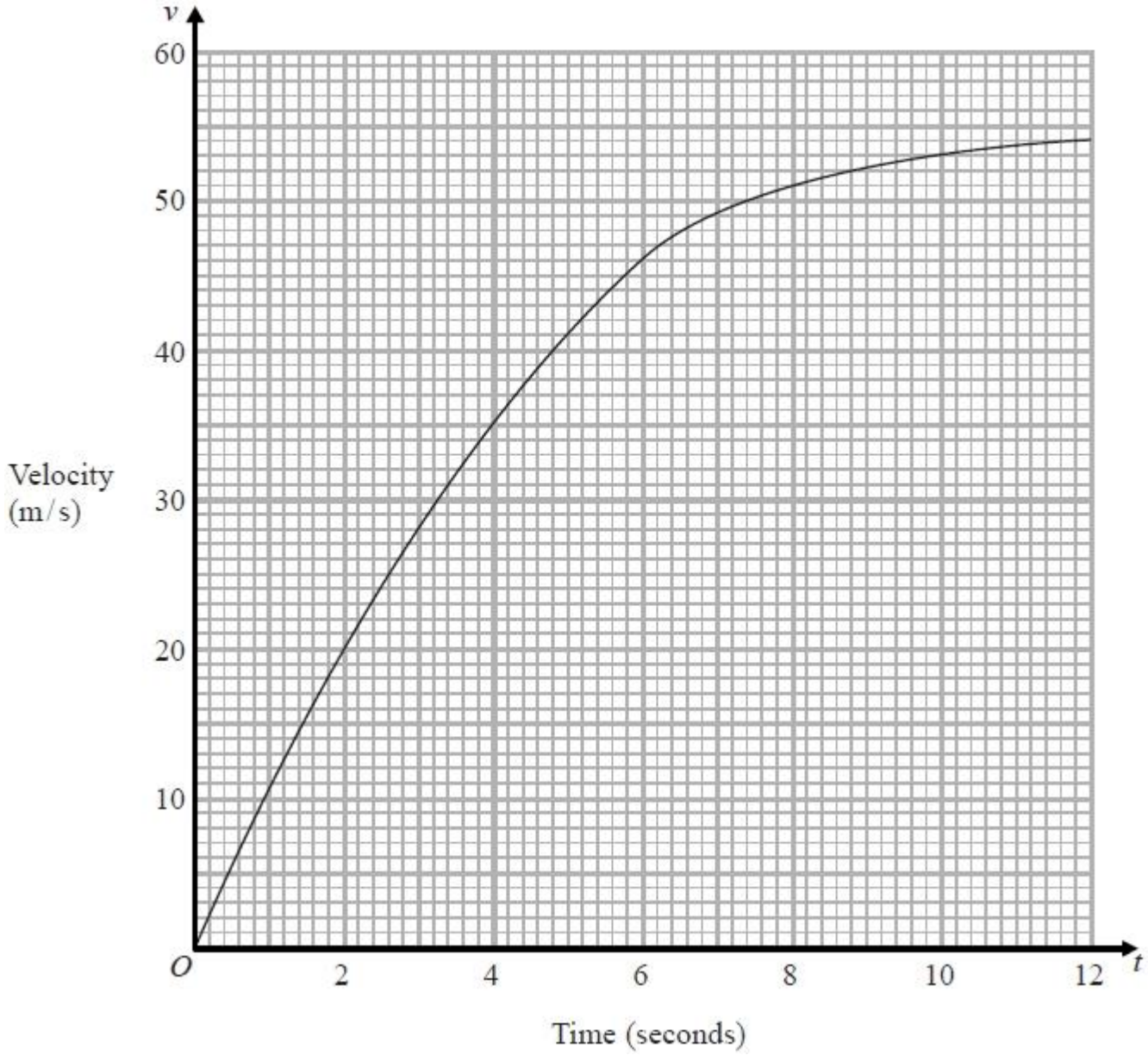
$T = 160$ when $d = 8$

Find the value of T when $d = 0.5$

.....

(Total for Question is 3 marks)

Q8.
The graph shows information about the velocity, v m/s, of a parachutist t seconds after leaving a plane.



(a) Work out an estimate for the acceleration of the parachutist at $t = 6$

..... m/s^2

(2)

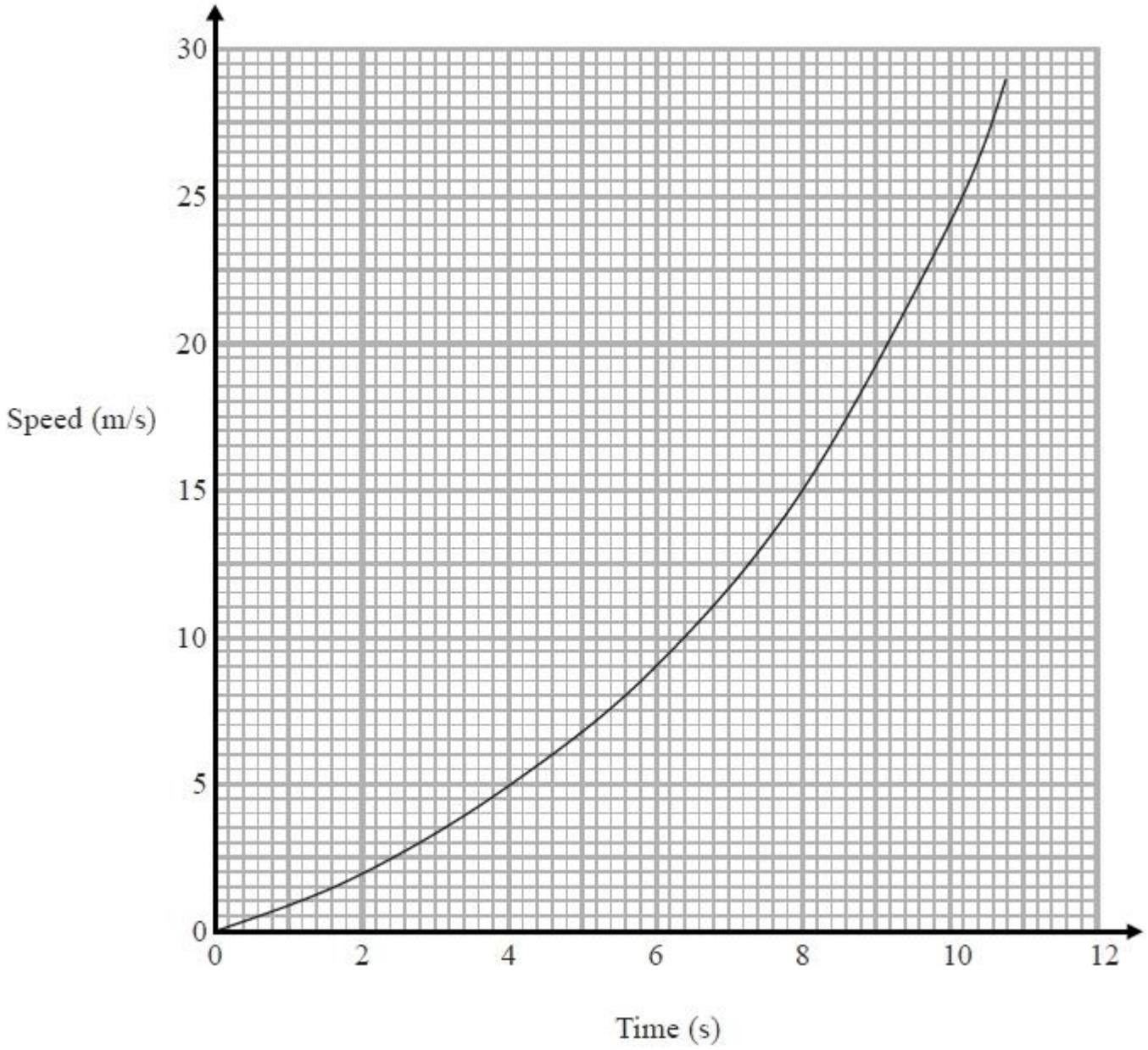
(b) Work out an estimate for the distance fallen by the parachutist in the first 12 seconds after leaving the plane.
Use 3 strips of equal width.

..... m

(3)

(Total for question is 5 marks)

Q9.
Here is a speed-time graph for a car.



(a) Work out an estimate for the distance the car travelled in the first 10 seconds.
Use 5 strips of equal width.

..... m

(3)

(b) Is your answer to (a) an underestimate or an overestimate of the actual distance?
Give a reason for your answer.

.....

.....

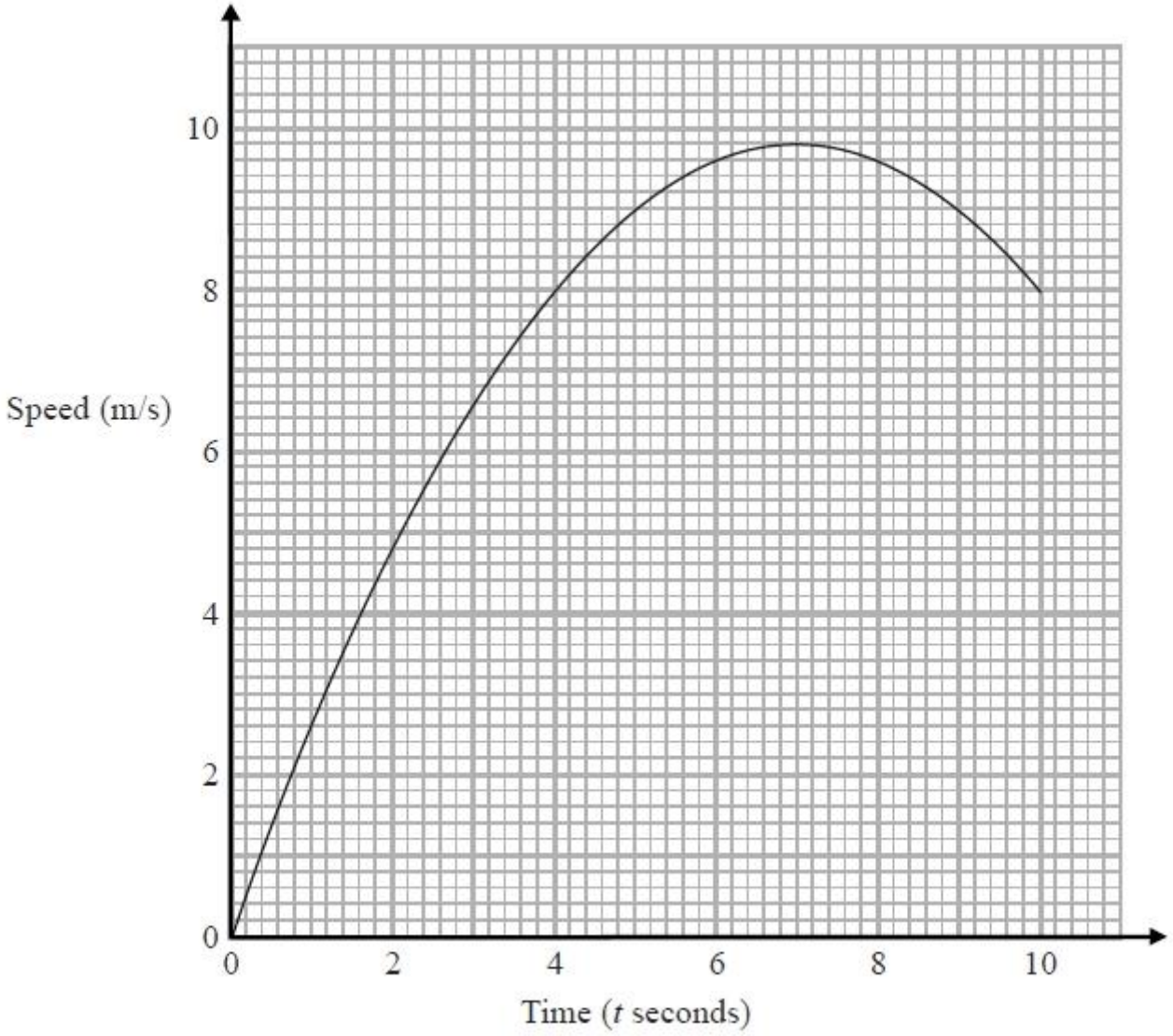
(1)

(Total for question = 4 marks)

Q10.

Karol runs in a race.

The graph shows her speed, in metres per second, *t* seconds after the start of the race.



(a) Calculate an estimate for the gradient of the graph when $t = 4$
You must show how you get your answer.

.....

(3)

(b) Describe fully what your answer to part (a) represents.

.....

.....

(2)

(c) Explain why your answer to part (a) is only an estimate.

.....

.....

(1)

(Total for question = 6 marks)

Q11.

D is directly proportional to the cube of *n*.

Mary says that when *n* is doubled, the value of *D* is multiplied by 6

Mary is wrong.
Explain why.

.....

.....

.....

(1)

(Total for question = 1 mark)

Q12.

Louis and Robert are investigating the growth in the population of a type of bacteria.
They have two flasks A and B.

At the start of day 1, there are 1000 bacteria in flask A.
The population of bacteria grows exponentially at the rate of 50% per day.

(a) Show that the population of bacteria in flask A at the start of each day forms a geometric progression.

(2)

The population of bacteria in flask A at the start of the 10th day is k times the population of bacteria in flask A at the start of the 6th day.

(b) Find the value of k.

.....

(2)

At the start of day 1 there are 1000 bacteria in flask B.
The population of bacteria in flask B grows exponentially at the rate of 30% per day.

(c) Sketch a graph to compare the size of the population of bacteria in flask A and in flask B.

(1)

(Total for question = 5 marks)

Q13.

A pendulum of length L cm has time period T seconds.
T is directly proportional to the square root of L.

The length of the pendulum is increased by 40%.

Work out the percentage increase in the time period.

..... %

(Total for question is 3 marks)

Examiner's Report

Q1.

Part (a) was well done by the majority of candidates. However, there were a significant number of candidates who made no attempt to complete the table.

Most candidates who completed the table went onto score at least one mark in part (b). Common errors were (0.5, 3) and (5, 1.25). There continues to be a number of candidates who plot the points from the table and then just leave the graph as a series of plotted points rather than attempting to draw a smooth curve. Some candidates did join their points but with straight line segments rather than a smooth curve.

One fairly common incorrect response was to plot all of the points but only join the points from (1, 6) to (6, 1), not from (0.5, 12).

Q2.
No Examiner's Report available for this question

Q3.
No Examiner's Report available for this question

Q4.

Candidates in GCSE Mathematics usually struggle with transformation of functions and this question was no exception. In part (a), less than a quarter could show that they understood that $-f(x)$ was a reflection of the curve in the x axis and that (0, 4) and (−4, 4) reflected to (0, −4) and (−4, −4) respectively, but half of these could show an inverted parabola with a maximum point shown at (−2, 0). Many candidates lost a mark as their inverted parabola was hastily drawn and did not pass through the required points.

In part (b), very few candidates could write $y = f(x - 6)$ as the required equation of the translation with $y = f(x + 6)$ and $y = f(x) + 6$ being the most common wrong answers, with a few gaining the mark for writing $y = (x - 4)^2$.

Q5.
No Examiner's Report available for this question

Q6.
No Examiner's Report available for this question

Q7.
This inverse proportion question differentiated between candidates. Some candidates followed the complete method expected for full marks but it was not done well by the majority of candidates, with some not even attempting it. Of those who established the usual routine with a proportion sign and then the use of the constant k, many used direct proportion or inverse (rather than inverse square) proportion and gained no marks. When candidates did write down a correct algebraic statement, the rearrangement of the equation to make k the subject sometimes went wrong. Many of the candidates who correctly found the value of k then went on to achieve full marks. Some, though, got an incorrect final answer through careless substitution. A common incorrect answer was 10, obtained from $^{160}/_{8} = 20$ followed by $0.5 \times 20 = 10$.

Q8.
No Examiner's Report available for this question

Q9.
No Examiner's Report available for this question

Q10.
No Examiner's Report available for this question

Q11.
No Examiner's Report available for this question

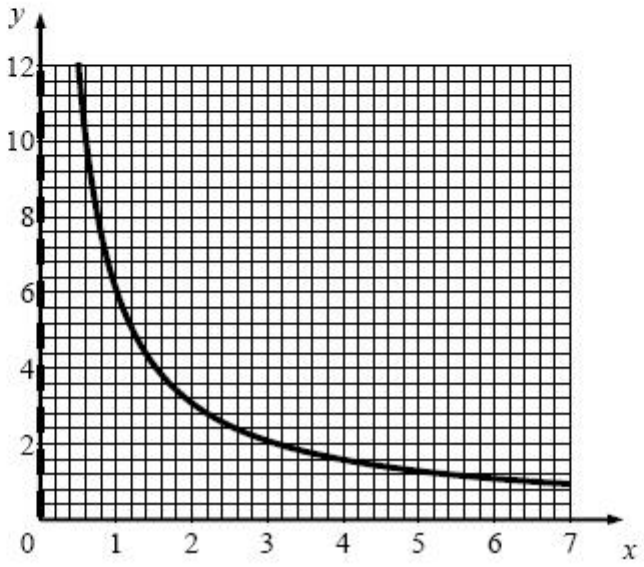
Q12.
No Examiner's Report available for this question

Q13.
No Examiner's Report available for this question

Mark Scheme

Q1.

Question		Working	Answer	Mark	Notes
	(a)	x 0.5 1 2 3 4 5 6 y 12 (6) (3) 2 (1.5) 1.2 (1)	Correct table	2	B2 all 3 correct (B1 1 or 2 correct)
	(b)		Correct graph	2	M1 at least 6 points plotted correctly from their table A1 cao for correct curve drawn from (0.5, 12) to (6, 1)



Q2.

Paper 1MA1:3H			
Question	**Working**	**Answer**	**Notes**
		(6, −1)	M1 for a method showing the translation of a graph or a correct coordinate A1 cao

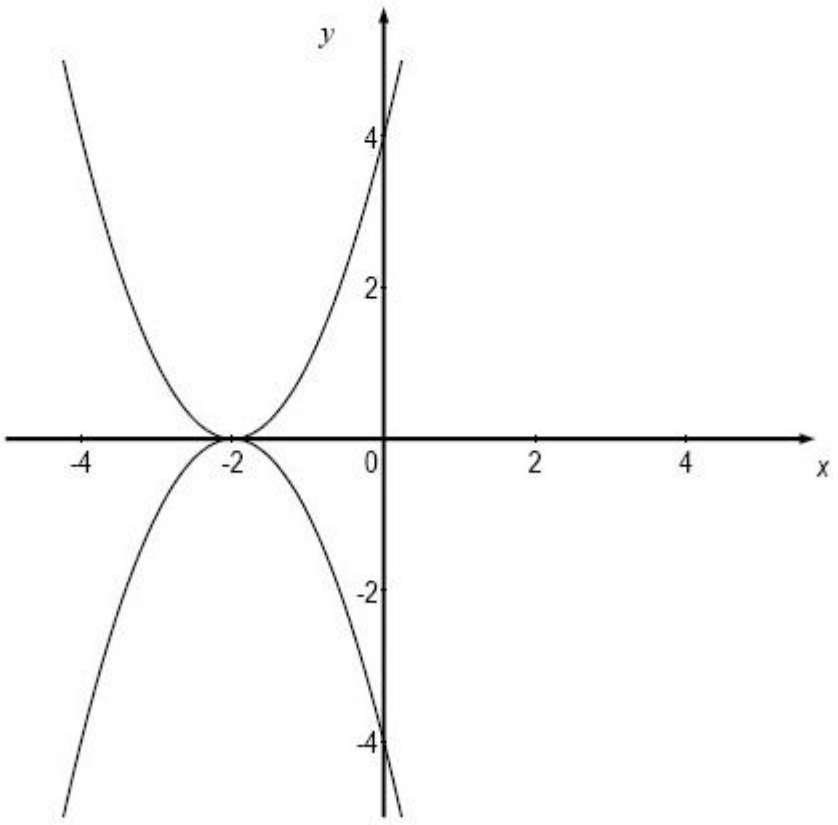
Q3.

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
(a)		Sketch	P1 Parabola passes through all three of the points (0, 4), (2,0), (4,4)
(b)		Sketch	P1 Parabola passes through all three of the points (–4, –1), (–2, 3), (0, –1)

Q4.

		Working	Answer	Mark	Notes
	(a)		sketch		M1 for inverting the parabola, so maximum is at (–2, 0) A1 for parabola passing through all three of the points (–2, 0), (0, –4), (–4, –4)
	(b)		$y = f(x - 6)$	1	B1 for $y = f(x - 6)$ or $y = (x - 4)^2$ oe

(a)



Q5.

Paper 1MA1: 1H			
Question	**Working**	**Answer**	**Notes**
		D, A, B, C	B1 for at least 2 correct B1 for all correct

Q6.

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
		20	M1 Establishing method linked to proportion eg. $d = k \div c$ or $25 = k \div 280$ M1 (dep) substitution eg. $d = 7000 \div 350$ or $25 \times 280 \div 350$ oe A1 cao

Q7.

		Working	Answer	Mark	Notes
			40960	3	M1 for $T \propto {}^{1}/_{d^2}$ or $T = {}^{k}/_{d^2}$ or $k = Td^2$ M1 for $k = 160 \times 8^2$ (= 10240) A1 for 40960

Q8.

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
(a)		3 to 4	C1 for a tangent drawn at $t = 6$ B1 for answer in range 3 to 4
(b)		452	C1 for splitting the area into 3 strips and a method of finding the area of one shape under the graph, eg. $\frac{1}{2} \times 4 \times 35$ (= 70) M1 for complete process to find the area under the graph, eg "70" + $\frac{1}{2} \times 4 \times (35 + 51)$ (= 172) + $\frac{1}{2} \times 4 \times (51 + 54)$ (= 210) [= 452] A1 for 452

Q9.

Question	Working	Answer	Notes
(a)	values 0, 2, 5, 9, 15, 24	86	M1 for starting to find area under curve M1 for method to find the area under the curve between $t = 0$ and $t = 10$ (and at least 2 areas) A1
(b)		overestimate with reason	C1 for overestimate and appropriate reason linked to method eg area between trapeziums and curve also included

Q10.

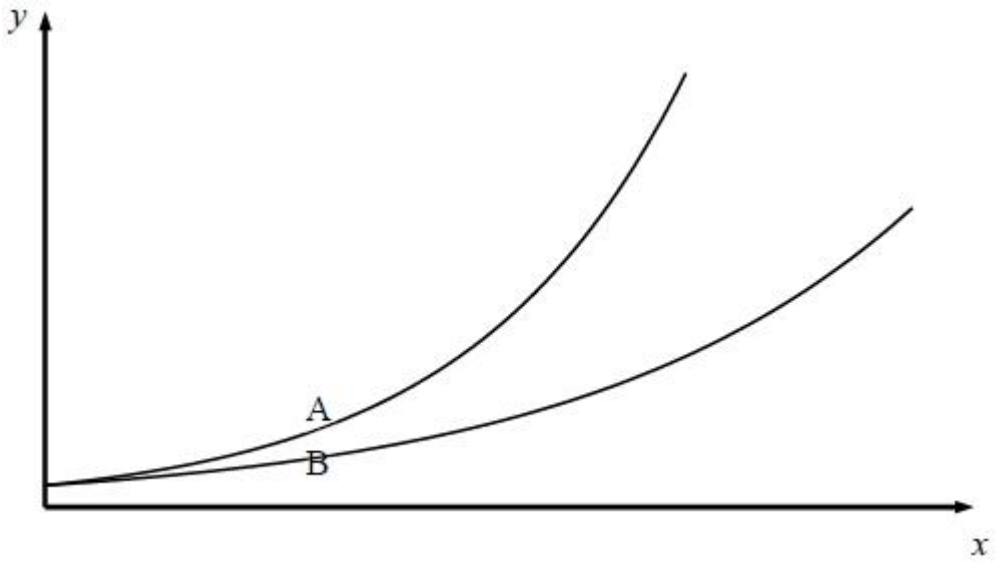
Question	Working	Answer	Notes	
(a)		1.0 – 1.3	M1	for finding gradient by drawing tangent
			M1	for method to calculate gradient
			A1	For 1.0 – 1.3
(b)			C1	for acceleration
			C1	for eg " 4 second after the start of the race", "when the speed is 7.6 m/s", "in m/s^2"
(c)		limitation	C1	for comment, eg dependent on accuracy of constructing a tangent

Q11.

Question	Working	Answer	Notes	
		explanation	C1	for a correct evaluation, eg the value of D should be multiplied by 8, she has used 2×3 instead of 2^3

Q12.

Paper 1MA1: 3H			
Question	**Working**	**Answer**	**Notes**
(a)	1000, 1500, 2250, ...	Correct Argument	M1 Method to find 1st 3 terms C1 Convincing reason eg. common ratio is 1.5
(b)	$1000\times1.5^9 = k\times1000\times1.5^5$ $k=\frac{1.5^9}{1.5^5}$	5.0625	P1 Process to find the value of k A1
(c)		Correct sketches	C1 Draws both exponential curves intersecting on y axis and clearly labelled



Q13.

Paper 1MA1: 2H			
Question	**Working**	**Answer**	**Notes**
		18.3	P1 for a start to the process interpreting the information correctly, eg. $T = k\sqrt{L}$ oe P1 for next stage in process to find percentage change in T, eg. $\sqrt{1.4}$ A1 for 18.3 to 18.4