OCR-H M/J '17 P4

Answer **all** the questions.

1 Calculate.

(a) $\sqrt{\frac{4.8^2 + 3.6^2}{4}}$

36 ✓

3 ✓

(a) ..... [2]

(b) $\frac{1}{(2 \times 10^4) + (5 \times 10^3)}$

25000 ✓

$\frac{1}{25000}$ ✓

(b) ..... [2]

2 The length, L, of a steel rod is 8.3 m, correct to 1 decimal place.

Complete the error interval for length L.

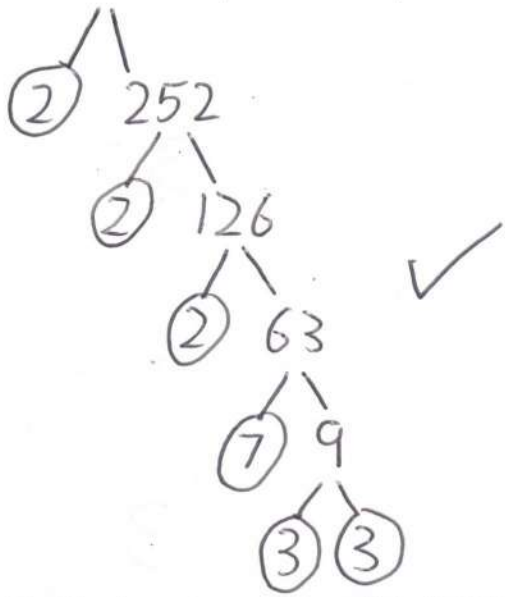
$\pm \frac{1}{2}$

± 0.05

8.25 ✓ $\leqslant L <$ 8.35 ✓ [2]

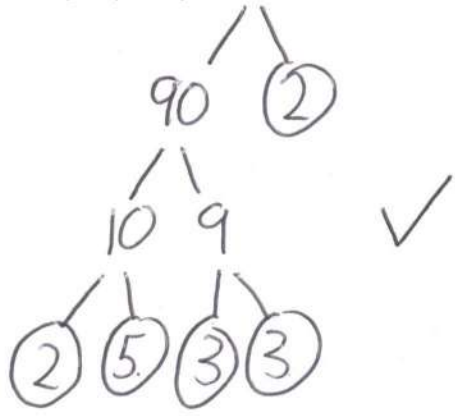
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3 (a) Write 504 as the product of its prime factors.

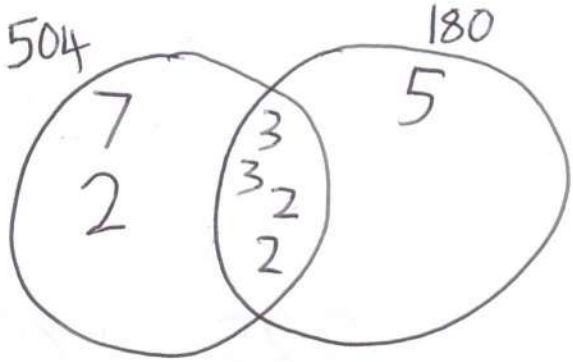


(a) $7 \times 3^2 \times 2^3$ [3]

(b) Find the lowest common multiple (LCM) of 180 and 504.



(b) 2520 [2]



LCM = $7 \times 3 \times 3 \times 2 \times 2 \times 5 \times 2$

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4 Find the value of s when $u = 12$, $a = 10$ and $t = 4$.

$s = ut + \frac{1}{2}at^2$

$s = 12 \times 4 + \frac{1}{2} \times 10 \times 4^2$ ✓

$= 48 + 80$

128 ✓

..... [2]

5 Mo's tyre pressure gauge shows a reading which is 12% higher than the actual pressure.

What is the actual pressure when Mo's gauge shows 38.64?

$? \times 1.12 = 38.64$ ✓

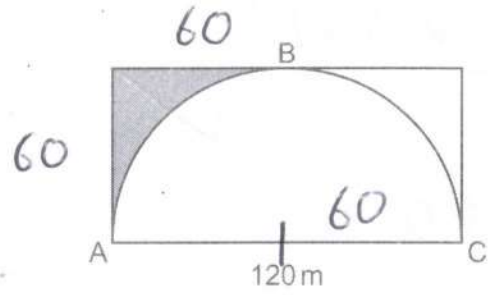
$? = \frac{38.64}{1.12}$ ✓ $= 34.5$ ✓

..... [3]

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6 The diagram shows a semi-circle inside a rectangle of length 120 m.
The semi-circle touches the rectangle at A, B and C.

Not to scale



Calculate the **perimeter** of the shaded region.
Give your answer correct to 3 significant figures.

Per = 60 + 60 + arc AB

$= 120 + \frac{1}{4} \times 2 \times \pi \times 60$

$= 120 + 30\pi$

$= 214.2...$

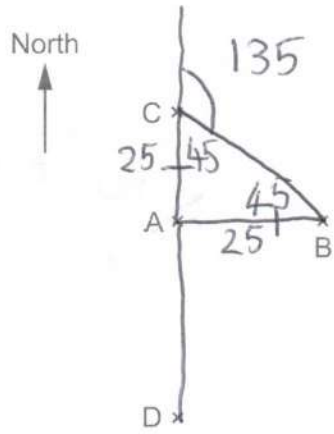
214

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

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7 A, B, C and D are four towns.

B is 25 kilometres due East of A.
C is 25 kilometres due North of A.
D is 45 kilometres due South of A.



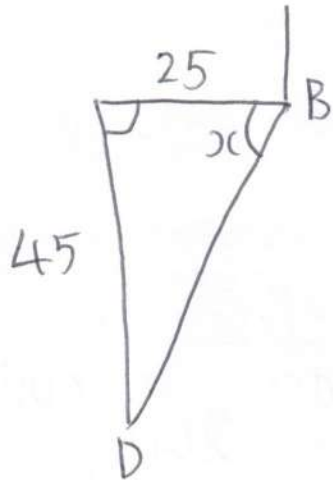
Not to scale

(a) Work out the bearing of B from C.

135

(a) ..... ° **[2]**

(b) Calculate the bearing of D from B.



$x = \tan^{-1}\left(\frac{45}{25}\right)$

$= 60.945...$

$270 - 60.945...$

209

(b) ..... ° **[4]**

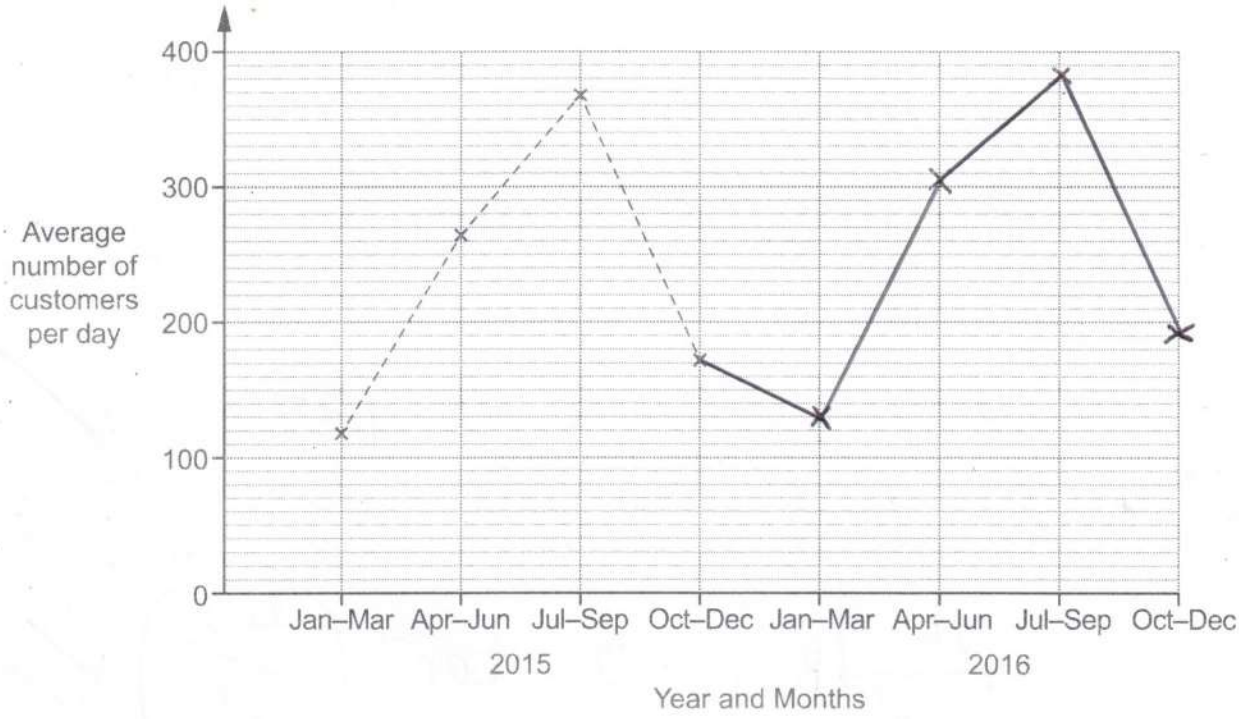
[209 → 209.1]

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8 The table shows the average number of customers per day entering a shop.

	2015				2016			
Months	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec	Jan-Mar	Apr-Jun	July-Sep	Oct-Dec
Average number of customers per day	119	264	368	172	130	304	381	192

(a) Complete the time series graph below.



2 ✓
4 ✓

[2]

(b) Make two different comments comparing the number of customers entering the shop in 2015 and 2016.

Comment 1 .....

Overall, slight increase in customers in 2016. ✓

Comment 2 .....

Summer months were busiest for each year. ✓

[2]

etc

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9 Each week Dan drives two routes, route X and route Y.

One week he drives route X three times and route Y twice.
He drives a total of 134 miles that week.

Another week he drives route X twice and route Y five times.
He drives a total of 203 miles that week.

(a) Find the length of each route.

$3X + 2Y = 134$ (×2)
$2X + 5Y = 203$ (×3) ✓✓

$6X + 4Y = 268$
$6X + 15Y = 609$ −
$-11Y = -341$ ✓

$Y = \frac{341}{11} = 31$

$3X + 2 \times 31 = 134$
$3X = 72$

(a) route X = 24 ✓ miles
route Y = 31 ✓ miles **[5]**

(b) State an assumption that has been made in answering part **(a)**.

No diversions ✓ or any distance comment **[1]**

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10 On 1st November 2015 there were 4200 trees planted in a wood.
On 1st November 2016, only 3948 of these trees were still alive.

It is assumed that the number of trees still alive is given by

$$N = ar^t$$

where N is the number of trees still alive t years after 1st November 2015.

(a) Write down the value of a.

(a) 4200 ✓ [1]

(b) Show that r is 0.94. **[2]**

$3948 = 4200 \times r^1$ ✓

$r = \frac{3948}{4200} = 0.94$ ✓

(c) Show that on 1st November 2030 the number of trees still alive is predicted to have decreased by over 60% compared with 1st November 2015. **[3]**

$0.4 \times 4200 = 1680$ ✓

$N = 4200 \times 0.94^{15}$

$= 1660.2...$ ✓

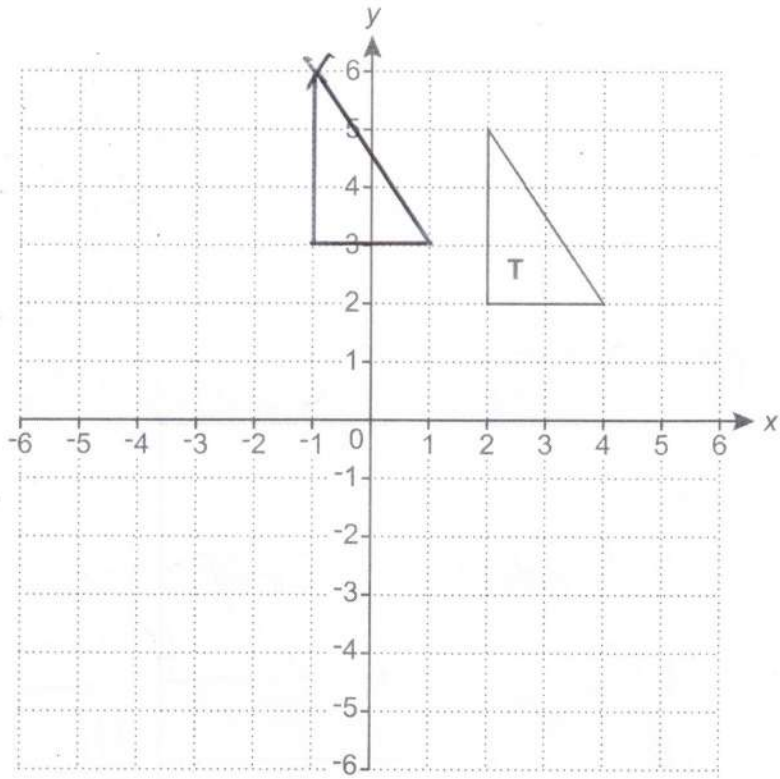
which is < 1680

or

$\therefore$ has decreased by $> 60\%$ ✓

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11 Triangle **T** is drawn on a coordinate grid.



(a) Translate triangle **T** using the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$. ← 3 ↑ 1 ✓✓ **[2]**

(b) Describe fully the **single** transformation that represents the following.

(i) A rotation with centre (0, 0) of 180° followed by a rotation with centre (0, 0) of 90° clockwise.

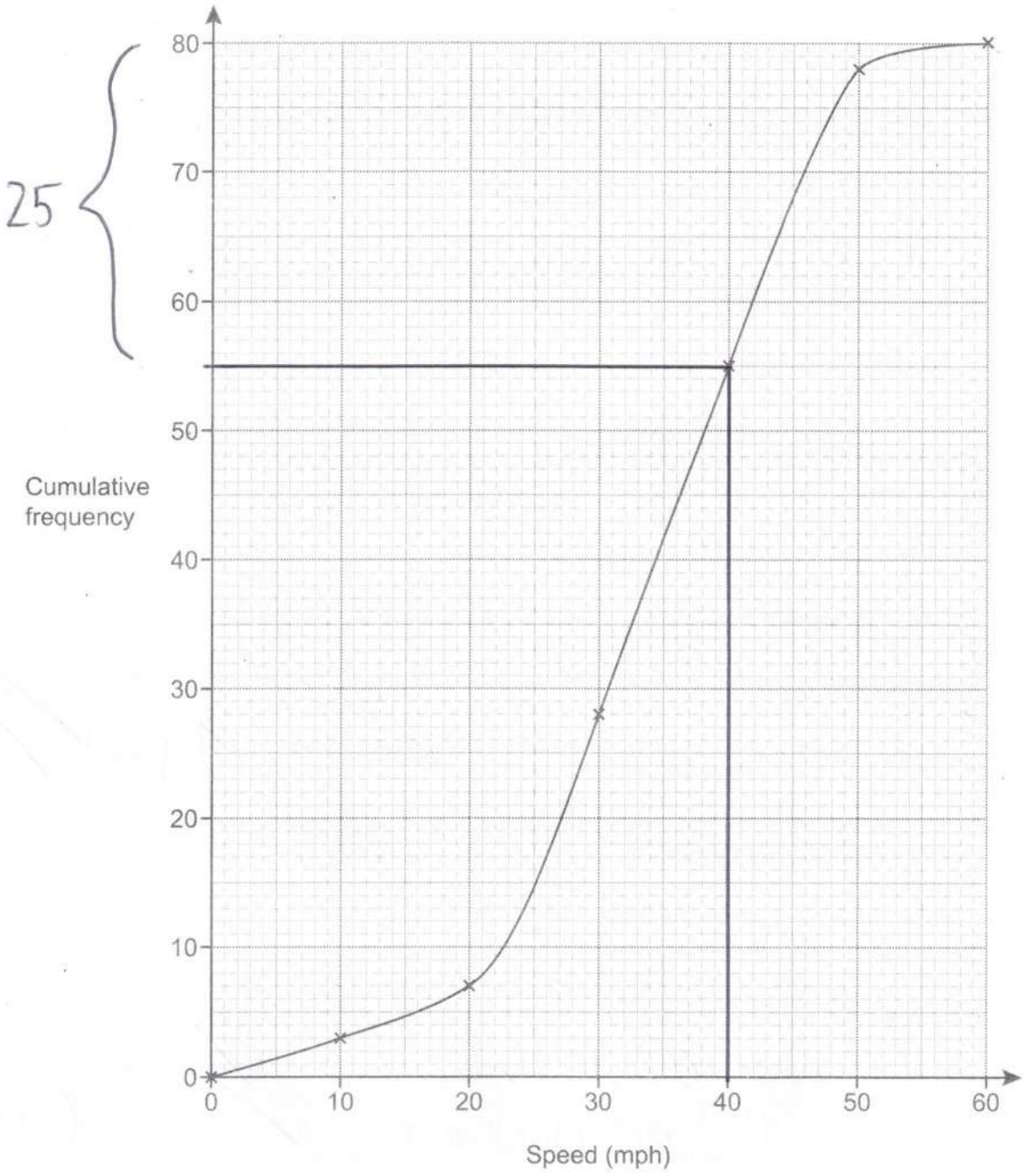
Rotation centre (0,0) ✓
90° anticlockwise ✓ (or 270dw)
[2]

(ii) A reflection in the *x*-axis followed by a reflection in the *y*-axis.

Rotation centre (0,0) 180°
✓ ✓ ✓
[3]

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12 The cumulative frequency graph shows the speeds, in miles per hour (mph), of vehicles passing a 40 mph speed limit sign on a road.



A speed camera will be installed if more than 30% of vehicles go over the speed limit of 40 mph.

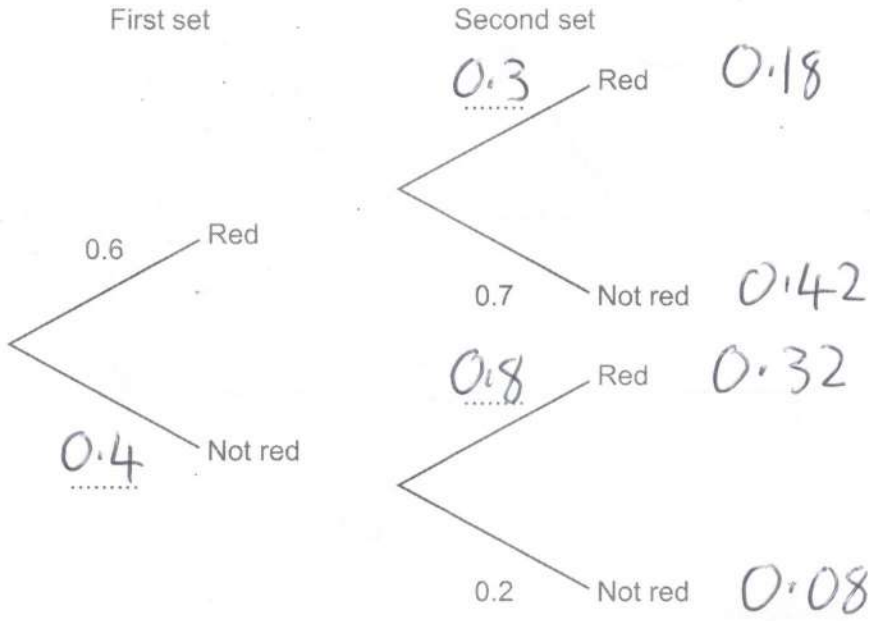
Use information from the graph to decide if a speed camera should be installed. **[4]**

30% of 80 = 24
>25 mph = 25

so Yes

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13 Rashid drives his car along a road passing through two sets of traffic lights.
The tree diagram shows the probabilities of the lights being **red** when he reaches them.



(a) Complete the tree diagram. **[1]**

(b) Write down the probability that the first set is **not red**.

(b) 0.4 ..... [1]

(c) Given that the first set is **red,** write down the probability that the second set is **not red**.

(c) 0.7 ..... [1]

(d) Work out the probability that both sets are **not red**.

(d) 0.08 ..... [2]

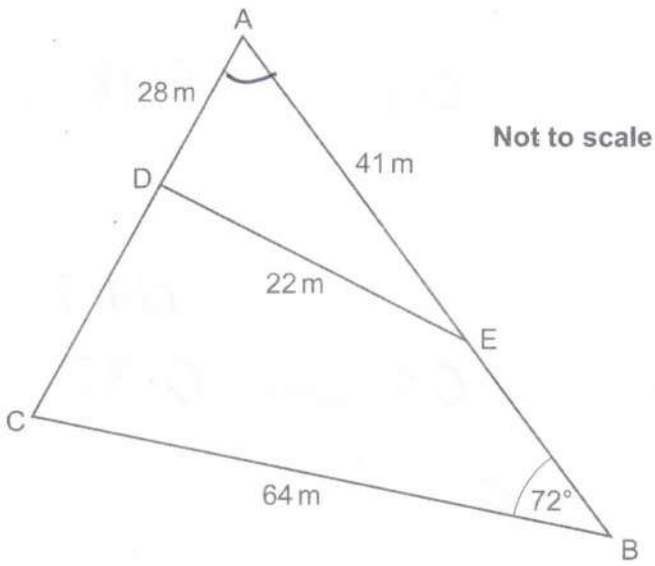
(e) Work out the probability that at least one set is **not red**.

0.42 + 0.32 + 0.08

(e) 0.82 ..... [3]

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14 The diagram shows triangle ABC with D on AC and E on AB.
DE is a straight line.



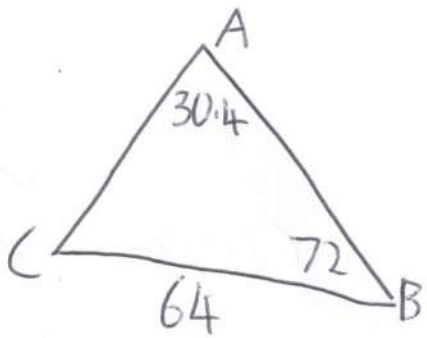
Not to scale

AD = 28 m, AE = 41 m, DE = 22 m and BC = 64 m.

Calculate the length CD.

$$\cos A = \frac{28^2 + 41^2 - 22^2}{2 \times 28 \times 41}$$ ✓✓

$$A = \cos^{-1}\left(\frac{283}{328}\right) = 30.4$$ ✓(1dp)



$$\frac{AC}{\sin 72} = \frac{64}{\sin 30.4}$$ ✓

$$AC = 120.4\ldots$$ ✓

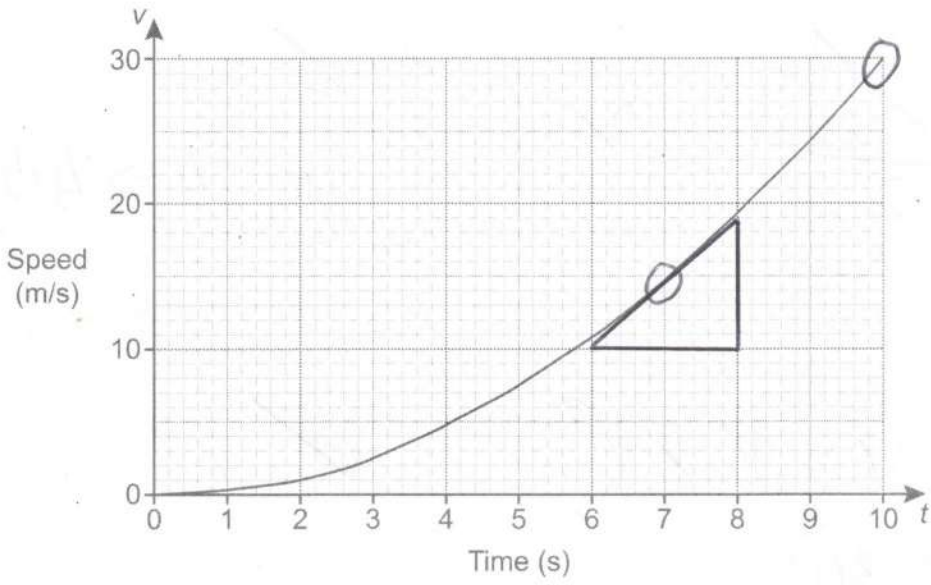
$$CD = 120.4 - 28 = 92.4$$ ✓

..... m **[6]**

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[92, 92·28 → 92·6]

15 The graph shows the speed, v metres per second (m/s), of a car at time t seconds.



(a) Find the speed of the car at $t = 7$.

[14 → 15]

(a) 14·5 ✓ ..... m/s **[1]**

(b) It is claimed that the car has accelerated from 0 to 60 miles per hour in the first 10 seconds.

Does the graph support this claim? Show your reasoning.
Use 1 mile = 1.6 kilometres. **[5]**

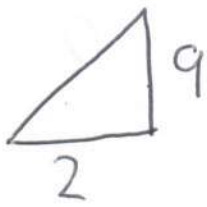
30 m / s ✓

$\frac{30 \times 60 \times 60}{1000 \times 1{\cdot}6}$ ✓✓

= 67·5 mph so Yes ✓

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(c) Use the graph to estimate the acceleration at $t = 7$.



✓ ÷ ✓

(c) [ms 4 → 4·5] ✓ ..... m/s² **[3]**

(d) The speed of this car is directly proportional to the square of the time.

Find a formula linking v and t.

$v = k \times t^2$ ✓

(10, 30)

$30 = k \times 10^2$

$k = 0.3$ ✓

(d) $v = 0.3 \times t^2$ ✓ ..... **[3]**

[0.25 < k < 0.33]

(e) Georgina says that the graph shows that the speed of the car will continue to increase after 10 seconds.

Make one comment to show that this statement is incorrect.

Car eventually reaches a max speed ✓ OE ✓ **[1]**

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16 Write $x^2 - 10x + 16$ in the form $(x + a)^2 + b$.

$(x-5)^2 - 25 + 16$ m ✓

$(x-5)^2 - 9$ ✓✓

..... [3]

17 Describe fully the graph which has the equation $x^2 + y^2 = 9$.

circle, centre $(0, 0)$ radius $= 3$

..... [2]

✓ ✓

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18 **(a)** Solve by factorisation.

$2x^2 + 5x - 12 = 0$

$(2x - 3)(x + 4) = 0$ ✓✓

(a) $x =$ $\frac{3}{2}$ or $x =$ -4 ✓ **[3]**

(b) Solve this equation.
Give each value correct to 2 decimal places.

$3x^2 + 2x - 3 = 0$

a b c

$$\frac{-2 \pm \sqrt{4 + 36}}{6}$$ ✓✓

0.7207... , −1.3874...

(b) $x =$ 0.72 or $x =$ −1.39 ✓ **[3]**

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19 **(a)** Here are the first four terms of a sequence.

$\frac{1}{2}$ $\frac{4}{3}$ $\frac{9}{4}$ $\frac{16}{5}$

Find the nth term of this sequence.

$\frac{n^2}{n+1}$ ✓ ✓

(a) ..... **[2]**

(b) Here are the first four terms of a quadratic sequence, the nth term of this quadratic sequence is $an^2 + bn + c$.

Find the values of a, b and c.

2 12 28 50

10 16 22

6 6 → $3n^2$

$3n^2$	3	12	27	48
$5-3n^2$	-1	0	1	2

+1 +1 +1 (✓)

(b) a = 3 ✓✓

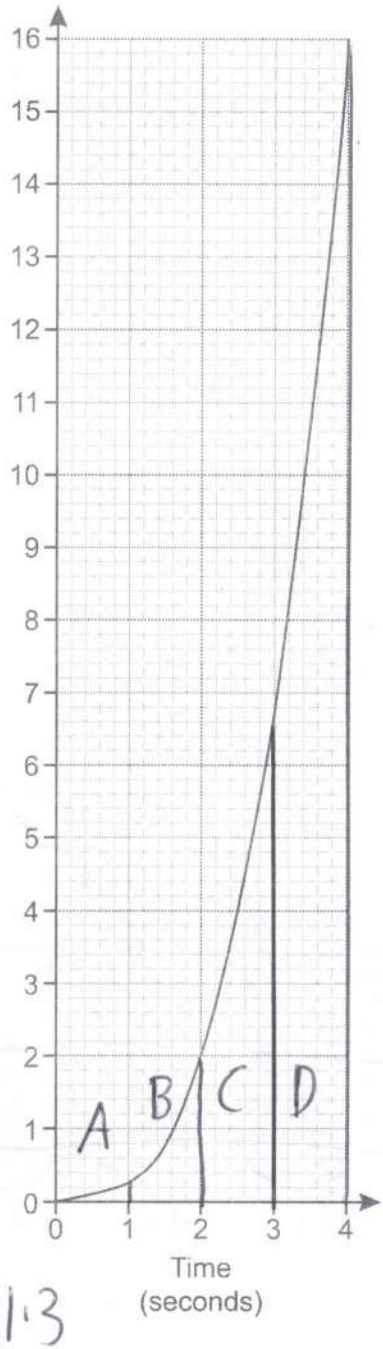
b = 1 ✓

c = -2 ✓

[4]

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20 The graph shows the speed, in metres per second, of a particle over the first four seconds of motion.



$A = \frac{1}{2} \times 1 \times 0.2$
$= 0.1$

$B = \frac{1}{2}(0.2 + 2) \times 1$
$= 1.1$

$C = \frac{1}{2}(2 + 6.6) \times 1$
$= 4.3$

$D = \frac{1}{2}(6.6 + 16) \times 1$
$= 11.3$

m ✓

Use the graph to estimate the distance travelled by the particle in the four seconds.

$0.1 + 1.1 + 4.3 + 11.3$

16.8 ✓

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

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END OF QUESTION PAPER

[ms 15 → 22]