

Q1. P is inversely proportional to d^2 .

$P = 10\,000$ when $d = 0.4$.

Find the value of P when $d = 0.8$.

$P = \dots\dots\dots$

(Total 3 marks)

Q2. q is inversely proportional to the square of t .

When $t = 4$, $q = 8.5$

(a) Find a formula for q in terms of t .

$q = \dots\dots\dots$

(3)

(b) Calculate the value of q when $t = 5$

.....

(1)
(Total 4 marks)

Q3. D is proportional to S^2 .

$$D = 900 \text{ when } S = 20$$

Calculate the value of D when $S = 25$

$$D = \dots\dots\dots$$

(Total 4 marks)

Q4. Julie buys 19 identical calculators.
The total cost is £143.64

Work out the total cost of 31 of these calculators.

£

(Total 3 marks)

Q5. M is directly proportional to L^3 .

When $L = 2$, $M = 160$

Find the value of M when $L = 3$

.....

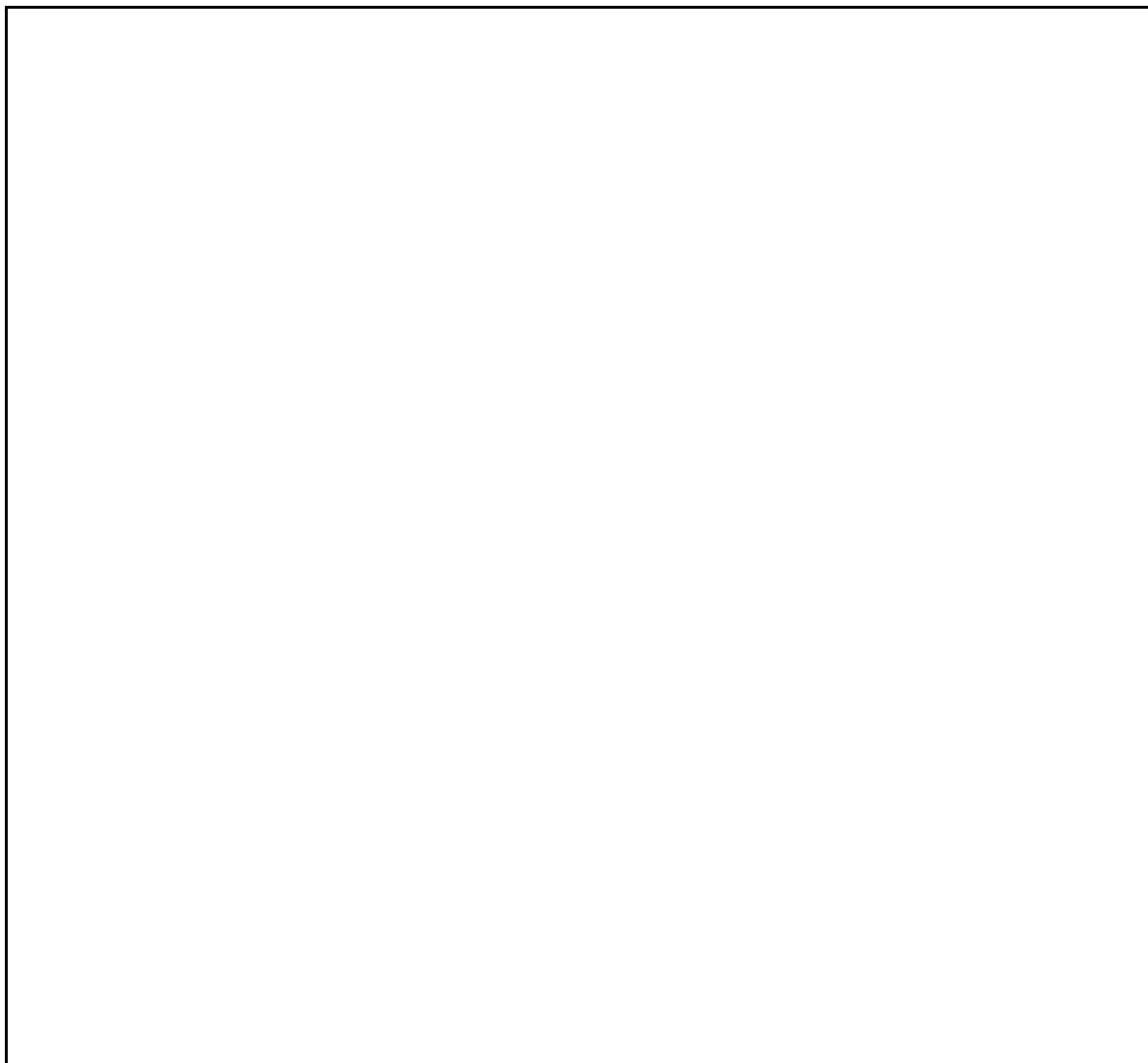
(Total 4 marks)

Q6. The time, T seconds, for a hot sphere to cool is proportional to the square root of the surface area, A m², of the sphere.

When $A = 100$, $T = 40$.

Find the value of T when $A = 60$.

Give your answer correct to 3 significant figures.

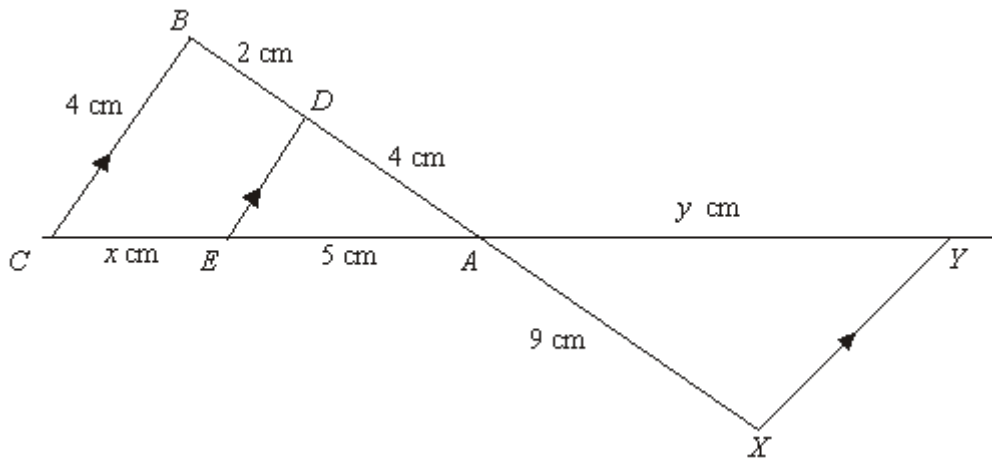


..... seconds

(Total 4 marks)

Q7.

Diagram **NOT**
accurately drawn



$CEAY$ and $BDAX$ are straight lines.

XY , ED and CB are parallel.

$AE = 5$ cm.

$AX = 9$ cm.

$AD = 4$ cm.

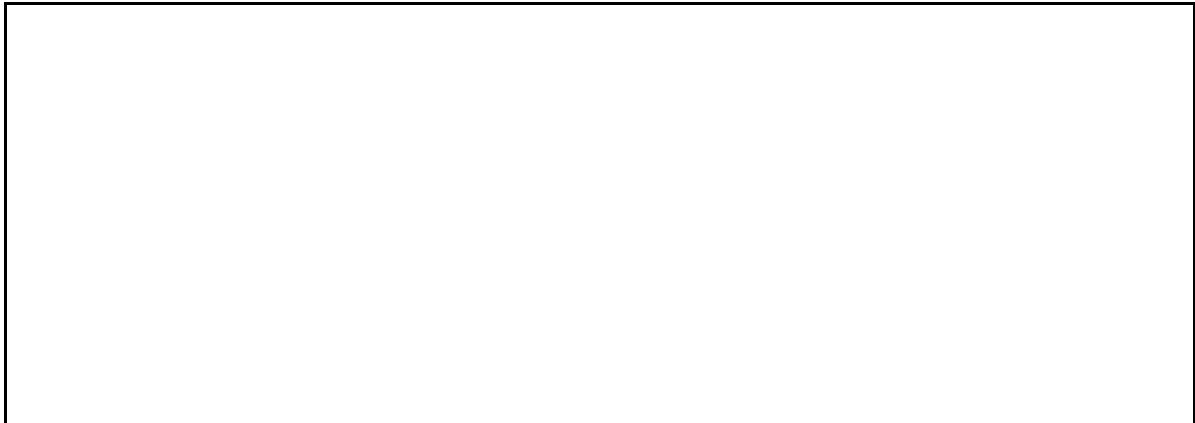
$BC = 4$ cm.

$BD = 2$ cm.

$CE = x$ cm.

$XY = y$ cm.

Find the value of x and the value of y .



$x = \dots\dots\dots$

$y = \dots\dots\dots$

(Total 4 marks)

M1.

Working	Answer	Mark	Additional Guidance
$P = \frac{k}{d^2}$ $k = Pd^2 = 10000 \times 0.4^2$ $= 1600$ <p>when $d = 0.8$, $P = \frac{1600}{0.8^2}$</p>	2500	3	$P \propto \frac{1}{d^2}$ <p>M1 $P = \frac{k}{d^2}$ or $P \propto \frac{1}{d^2}$</p> <p>M1 $k = 10000 \times 0.4^2$</p> <p>A1 2500 cao</p> <p>OR</p> $\frac{x}{10000} = \frac{0.4^2}{0.8^2}$ <p>M1 $\frac{x}{10000} = \frac{0.4^2}{0.8^2}$</p> $\frac{0.4^2}{0.8^2} \times 10000$ <p>M1 $\frac{0.4^2}{0.8^2} \times 10000$</p> <p>A1 2500 cao</p>
Total for Question: 3 marks			

M2.

	Working	Answer	Mark	Additional Guidance
(a)	$q = \frac{k}{t^2}; 8.5 = \frac{k}{4^2}$ $k = 8.5 \times 4^2;$ $k = 136$	$q = \frac{136}{t^2}$	3	$q = \frac{k}{t^2}, (k \neq 1)$ <p>M1 $q = \frac{k}{t^2}, (k \neq 1)$</p> $8.5 = \frac{k}{4^2}$ <p>M1 $8.5 = \frac{k}{4^2}$</p> <p>A1 cao</p> <p>NB $q = \frac{k}{t^2}$ in the answer line followed by k being found correctly anywhere in (a) or (b) earns all 3 marks</p>

(b)	$q = \frac{136}{5^2}$ $= \frac{136}{25}$	5.44	1	$\frac{136}{25}$ oe B1 ft for
Total for Question: 4 marks				

M3.

Working	Answer	Mark	Additional Guidance
$D = kS^2$ $900 = k \times 20^2$ $k = \frac{900}{400}$ $D = \frac{900}{400} \times 25^2$ $= 1406.25$	1406.25	4	M1 $D = kS^2$ M1 $900 = k \times 20^2$ (can imply first M1) $k = \frac{900}{20^2}$ (= 2.25) A1 for 1406.25 or $\frac{5625}{4}$
Total for Question: 4 marks			

M4.

Working	Answer	Mark	Additional Guidance
$143.64 \div 19 = 7.56$ $7.56 \times 31 =$	234.36	3	M1 for $143.64 \div 19$ (or 7.56 seen) or 143.64×31 (or 4452.84 seen) M1 (dep) for '7.56' $\times 31$ or '4452.84' $\div 19$ or $143.64 + 12 \times 7.56$ A1 for 234.36 cao accept 234.36p Alternative method: M1 for (or 1.63(1...) seen) M1 (dep) '1.63...' $\times 143.64$

			A1 for 234.36 cao accept 234.36p
Total for Question: 3 marks			

M5.

Working	Answer	Mark	Additional Guidance
$M = kL^3$ $k = \frac{M}{L^3} = \frac{160}{8} = 20$ When $L = 3$, $M = 20 \times 3^3$	540	4	M1 for $M \propto L^3$ or $M = kL^3$ A1 $k = 20$ M1 for '20' $\times 3^3$ A1 for 540 cao
Total for Question: 4 marks			

M6.

Working	Answer	Mark	Additional Guidance
$T = k\sqrt{A}$; $40 = k\sqrt{100}$ $k = 4$ $T = 4\sqrt{A}$ $T = 4\sqrt{60}$	31.0	4	M1 $T = k\sqrt{A}$ M1 $40 = k\sqrt{100}$ A1 $T = 4\sqrt{A}$ A1 for 30.98... or 31(.0)

		OR	
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Total for Question: 4 marks

M7.

Working	Answer	Mark	Additional Guidance
$\frac{x}{5} = \frac{2}{4}$	$x = 2.05$	4	M1 a correct expression for x involving ratios of sides, e.g. $\frac{x}{5} = \frac{2}{4}$ oe A1 cao
$\frac{y}{x+5} = \frac{9}{6} \text{ or } \frac{y}{9} = \frac{x+5}{6}$	$y = 11.25$		

Total for Question: 4 marks

E1. Most candidates did not have a clear idea of completing this unstructured question.

The most successful approach came from candidates who started with $P = \frac{k}{d^2}$ and then went on to find the value of k . They usually completed the question to get the correct answer of 2500. A few candidates tried to deal with the squares directly without finding an algebraic formula. Many of these were just confused and completed the question by multiplying by 4 rather than dividing by 4 presumably from considering the problem as one of direct proportion.

E2. Proportionality laws are ubiquitous in science so it is not surprising that they get tested frequently at the higher level. Many candidates had the correct idea of writing the relationship as a formula involving a constant of proportionality k and then using the given information to find the value of k . After that, completing the question was straightforward. There were a few candidates who overlooked the word 'inverse' and changed the problem substantially. There were also many who answered the question for q directly proportional to t^2 or inversely proportional to t , or \sqrt{t} . Common wrong answers were $2t + 0.5$, $2.125t$ and $q = 34/t$

E3. Very few pupils started from $D = kS^2$ with only 17% of candidates gaining full marks, but those who did generally got the correct answer. The most common answer seen was 1125 which was arrived at by a variety of incorrect methods.

E4. Specification A

This was generally answered correctly, with most candidates using two steps, first dividing by 19 and then multiplying by 31. Sometimes candidates resorted to an unnecessarily

complicated method no doubt taught for situations when calculators are prohibited, e.g. find the cost of one, then 20, then thirty, and then add 1 more. Finding the cost of 1, then 12, then adding on was also quite popular.

Unfortunately the more steps that were involved the more mistakes and rounding errors that appeared. However by far the greatest source of mark loss in this question, was in misreads and transcription errors, 13 used instead of 31 being the most common.

Specification B

A well answered question with the vast majority of candidates who were very comfortable using the unitary method. A few unorthodox approaches were also seen involving the idea of $19 + 12$ or $38 - 7$. A few candidates when for halving, presumably under the misapprehension that $19 + 8 + 4$ gives 31 – which it does, but 8 is not half of 19. They got no marks.

- E5.** There were an encouraging number of fully correct answers. A large number of candidates, however, took M to be proportional to L instead of L^3 which resulted in 240 being the most common incorrect answer. Those who managed to get as far as $k = 20$ usually managed to complete the question successfully but it was not uncommon to see $20 \times 3^3 = 20 \times 9 = 180$. Some candidates incorrectly evaluated 2^3 as 8.