**Detailed marking instructions for each question.**

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **1.** | **Ans: 10** <br><br> $\bullet^1$ substitute into $x^2+3x$ <br><br> $\bullet^2$ evaluate $x^2+3x$ | $\bullet^1$ $(-5)^2+3\times(-5)$ <br><br> $\bullet^2$ 10 | **2** |

**Notes:**

1. Correct answer without working    award 0/2
2. Accept $-5^2+3\times-5$ for $\bullet^1$
3. For subsequent incorrect working, $\bullet^2$ is not available

**Commonly Observed Responses:**

1. (a) For $-5=(-5)^2+3\times(-5)\rightarrow-5=10$        award 2/2

   (b) For $-5=(-5)^2+3\times(-5)\rightarrow-5=10\ \rightarrow x=15$       award 1/2 ✓✗

2. For $5^2+3\times5=40$            award 0/2

3. For $5^2+3\times(-5)=10$          award 0/2

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **2.** | **Ans:  16** <br><br> $\bullet^1$ find quartiles <br><br> $\bullet^2$ calculate semi-interquartile range | $\bullet^1$ 218, 250 <br><br> $\bullet^2$ 16 | **2** |

**Notes:**

1. Correct answer without working           award 0/2
2. Accept quartiles indicated in the list or on a diagram for $\bullet^1$

**Commonly Observed Responses:**

1. For $\dfrac{267-198}{2}=34\cdot5$          award 0/2

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **3.** | Ans: $\dfrac{22}{9}$<br><br>• $^1$ start simplification and know how to divide fractions<br><br>• $^2$ consistent answer | • $^1$ $\dfrac{11}{6} \times \dfrac{4}{3}$<br><br>• $^2$ $\dfrac{22}{9}$ or $2\dfrac{4}{9}$ | 2 |

**Notes:**

1. Correct answer without working                                                                  award 0/2

2. Do not penalise incorrect conversion of $\dfrac{22}{9}$ to a mixed number

**Commonly Observed Responses:**

1. $\dfrac{11}{6} \times \dfrac{4}{3} = \dfrac{44}{18}$                                              award 1/2 ✓✗

2. $\dfrac{11}{6} \times \dfrac{3}{4} = \dfrac{11}{8}$                                              award 1/2 ✗✓

3. $\dfrac{6}{11} \times \dfrac{3}{4} = \dfrac{9}{22}$                                              award 1/2 ✗✓

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **4.** | **Ans:** $2x^3 - 5x^2 - 10x + 3$<br><br>$\bullet^1$ start to expand<br><br>$\bullet^2$ complete expansion<br><br>$\bullet^3$ collect like terms which must include a term in $x^3$ and a negative coefficient | <br><br>$\bullet^1$ evidence of any 3 correct terms eg $2x^3 - 8x^2 + 2x$<br><br>$\bullet^2$ $2x^3 - 8x^2 + 2x + 3x^2 - 12x + 3$<br><br>$\bullet^3$ $2x^3 - 5x^2 - 10x + 3$ | 3 |

**Notes:**

1. Correct answer with no working                                                                 award 3/3

2. For subsequent incorrect working, the final mark is not available

**Commonly Observed Responses:**

1. For eg $2x^3 - 8x^2 + 2x + 3x^2 + 12x + 3 = 2x^3 - 5x^2 + 14x + 3$      award 2/3 ✓×✓

2. For eg $2x^3 + 2x - 12x + 3 = 2x^3 - 10x + 3$      award 2/3 ✓×✓

3. For $2x^3 + 8x^2 + 2x + 3x^2 + 12x + 3 = 2x^3 + 11x^2 + 14x + 3$      award 1/3 ✓××

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **5.** | | | **Ans:** $B(0,6,6), C(3,3,9)$ | | 2 |
| | | | $\bullet^1$ Coordinate B | $\bullet^1$ $(0,6,6)$ | |
| | | | $\bullet^2$ Coordinate C | $\bullet^2$ $(3,3,9)$ | |

**Notes:**

1. The maximum mark available is 1/2 where
   (a) brackets are omitted
   (b) answers are given in component form

2. For $(6,6,0)$ **and** $(9,3,3)$ [repeated error]     award 1/2   $\times\checkmark$

**Commonly Observed Responses:**

1. For 0,6,6 and 3,3,9     award 1/2   $\times\checkmark$

2. For $\begin{pmatrix} 0 \\ 6 \\ 6 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 3 \\ 9 \end{pmatrix}$     award 1/2   $\times\checkmark$

3. For eg $\begin{pmatrix} 0 \\ 6 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} 3 \\ 3 \\ 9 \end{pmatrix}$     award 0/2

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **6.** | **Ans:** $y=-2x+4$ <br><br> **Method 1:** $y-b=m(x-a)$ <br><br> $\bullet^1$ find gradient <br><br> $\bullet^2$ substitute gradient and a point into $y-b=m(x-a)$ <br><br> $\bullet^3$ state equation in simplest form <br><br> **Method 2:** $y=mx+c$ <br><br> $\bullet^1$ find gradient <br><br> $\bullet^2$ substitute gradient and a point into $y=mx+c$ <br><br> $\bullet^3$ state equation in simplest form | $\bullet^1$ $-\dfrac{8}{4}$ or equivalent <br><br> $\bullet^2$ eg $\quad y-(-2)=-\dfrac{8}{4}(x-3)$ <br><br> $\bullet^3$ $\quad y=-2x+4$ **or equivalent** <br><br><br> $\bullet^1$ $-\dfrac{8}{4}$ <br><br> $\bullet^2$ eg $-2=-\dfrac{8}{4}\times 3+c$ <br><br> $\bullet^3$ $y=-2x+4$ or equivalent | 3 |

**Notes:**

1. Correct answer without working $\hspace{4cm}$ award 3/3

2. BEWARE $\quad \bullet^1$ is not available for $\dfrac{-2-6}{3-(-1)}=\dfrac{8}{-4}$ or $\dfrac{6-(-2)}{-1-3}=\dfrac{-8}{4}$

**Commonly Observed Responses:**

1. For a final answer of $y=-\dfrac{2}{1}x+4$ $\hspace{3cm}$ award 2/3 ✓✓✗

2. $y=2x+8$ $\quad [m=\dfrac{8}{4}\ (-1,6)]$ $\hspace{3cm}$ award 2/3 ✗✓✓

3. $y=2x-8$ $\quad [m=\dfrac{8}{4}\ (3,-2)]$ $\hspace{3cm}$ award 2/3 ✗✓✓

4. $m=\dfrac{4}{4}=1\rightarrow y-6=1(x-(-1))\rightarrow y=1x+7$ $\hspace{1cm}$ award 2/3 ✗✓✓

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **7.** | | | **Ans:** 32 cm$^2$ <br><br> $\bullet^1$ correct substitution into area of triangle formula <br><br> $\bullet^2$ calculate area | $\bullet^1$ $\frac{1}{2} \times 12 \times 8 \times \frac{2}{3}$ <br><br> $\bullet^2$ $32 \left( \text{cm}^2 \right)$ | **2** |

**Notes:**

1. Correct answer without working          award 1/2

**Commonly Observed Responses:**

1. For $\frac{1}{2} \times 12 \times 8 \times \sin\frac{2}{3} = 32$      award 1/2 ✗✓

2. For $\frac{1}{2} \times 12 \times 8 \times \sin\frac{2}{3}$      award 0/2

3. For $\frac{1}{2} \times 12 \times 8 = 48$      award 0/2

4. For (a) $\frac{1}{2} \times 12 \times 8 \times 0 \cdot \dot{6} = 32$ or $\frac{1}{2} \times 12 \times 8 \times 0 \cdot 666... = 32$      award 2/2

     (b) $\frac{1}{2} \times 12 \times 8 \times 0 \cdot 67 = 32 \cdot 16$ or $\frac{1}{2} \times 12 \times 8 \times 0 \cdot 66 = 31 \cdot 68$      award 1/2 ✗✓

     (c) $\frac{1}{2} \times 12 \times 8 \times 0 \cdot 7 = 33 \cdot 6$ or $\frac{1}{2} \times 12 \times 8 \times 0 \cdot 6 = 28 \cdot 8$      award 0/2

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **8.** | | | **Ans:** $x < 5$ <br><br> $\bullet^1$ expand bracket <br><br> $\bullet^2$ collect like terms <br><br> $\bullet^3$ solve for $x$ | $\bullet^1$ $3x - 6$ <br><br> $\bullet^2$ $-2x > -10$ or $10 > 2x$ <br><br> $\bullet^3$ $x < 5$ or $5 > x$ | **3** |

**Notes:**

1. Correct answer without valid working        award 0/3 <br> Treat guess and check as invalid working

**Commonly Observed Responses**

1. For $19 + x > 15 + 3x - 6 \rightarrow 2x > -10 \rightarrow x > -5$      award 1/3 ✓✗✗

2. For $19 + x > 15 + 3x - 2 \rightarrow -2x > -6 \rightarrow x < 3$      award 2/3 ✗✓✓

3. For $19 + x > 18(x - 2) \rightarrow 19 + x > 18x - 36 \rightarrow 55 > 17x \rightarrow \frac{55}{17} > x$      award 2/3 ✗✓✓

4. For (a) $19 + x = 15 + 3x - 6 \rightarrow -2x = -10 \rightarrow x = 5 \rightarrow x < 5$      award 3/3

     (b) $19 + x = 15 + 3x - 6 \rightarrow -2x = -10 \rightarrow x = 5$      award 2/3 ✓✓✗

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **9.** | **Ans:** 26° | | **3** |
| | **Method 1** | | |
| | •¹ calculate size of angle OBD | •¹ OBD = 32 | |
| | •² calculate size of angle ODB (ODB = OBD) | •² ODB = 32 | |
| | •³ calculate size of angle CAB | •³ CAB = 26 | |
| | **Method 2** | | |
| | •¹ calculate size of angle ABC | •¹ ABC = 32 | |
| | •² calculate size of angle OCB (OCB = 90 − ABC) | •² OCB = 58 | |
| | •³ calculate the size of angle CAB | •³ CAB = 26 | |

**Notes:**

1. Check both methods and award the higher mark.
2. Full marks may be awarded for information marked on the diagram.
3. Where information is not marked on the diagram then working must clearly attach calculations to **named** angles.
4. For an answer of 26° with no relevant working                     award 0/3
5. Where candidate uses triangle ABO, •³ is available for ABO = 90 and answer to CAB = 90 − AOB
   eg OBD = 32;   AOB = 32;   ABO = 90 and CAB = 58          award 2/3 ✓✗✓

**Commonly Observed Responses:**

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **10.** | **Ans:** $b = \dfrac{Fc - t^2}{4}$ **or equivalent** <br><br> •$^1$ multiply by $c$ <br><br> •$^2$ subtract $t^2$ <br><br> •$^3$ divide by 4 | •$^1$ $Fc = t^2 + 4b$ <br><br> •$^2$ $4b = Fc - t^2$ <br><br> •$^3$ $b = \dfrac{Fc - t^2}{4}$ | **3** |

**Notes:**

1. Correct answer without working  3/3

**Commonly Observed Responses:**

1. For $b = \dfrac{c \times f - t^2}{4}$          award 3/3

2. For $b = \dfrac{t^2 - Fc}{-4}$          award 3/3

3. For $b = \dfrac{Fc}{4} - \dfrac{t^2}{4}$          award 3/3

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **11.** | **Ans:** $\dfrac{3-2a}{a^2}$<br><br>$\bullet^1$ valid common denominator<br><br>$\bullet^2$ answer in simplest form | <br><br>$\bullet^1$ $\dfrac{}{a^2}$ or $\dfrac{}{a^3}$ or $\dfrac{}{a^2 \times a}$<br><br>$\bullet^2$ $\dfrac{3-2a}{a^2}$ | 2 |

**Notes:**

1. Correct answer without working                                           award 2/2

2. For subsequent incorrect working, the final mark is not available

   eg $\dfrac{3-2\cancel{a}}{\cancel{a}^2} = \dfrac{3-2}{a} = \dfrac{1}{a}$                 award 1/2 ✓×

3. For $\dfrac{3}{a^2} - \dfrac{2}{a} = \dfrac{1}{a}$                                 award 0/2

**Commonly Observed Responses:**

1. For $\dfrac{3a-2a^2}{a \times a^2}$                                           award 1/2 ✓×

2. For $\dfrac{3}{a^2} - \dfrac{2a}{a^2}$                                           award 1/2 ✓×

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **12.** | **Ans:** $a = 3, b = 2$ | | 4 |
| | **Method 1** | | |
| | $\bullet^1$ find $\overline{x}$ | $\bullet^1$ $\overline{x} = 4$ | |
| | $\bullet^2$ find $\left(x - \overline{x}\right)^2$ | $\bullet^2$ 9, 0, 4, 1, 4 | |
| | $\bullet^3$ substitute into formula and start to evaluate | $\bullet^3$ $\sqrt{\dfrac{18}{4}}$ | |
| | $\bullet^4$ find values of $a$ and $b$ | $\bullet^4$ $a = 3, b = 2$ or $\dfrac{3\sqrt{2}}{2}$ | |
| | **Method 2** | | |
| | $\bullet^1$ find $\sum x$ and $\sum x^2$ | $\bullet^1$ $\sum x = 20$ and $\sum x^2 = 98$ | |
| | $\bullet^2$ substitute into formula | $\bullet^2$ $\sqrt{\dfrac{98 - \dfrac{20^2}{5}}{5 - 1}}$ | |
| | $\bullet^3$ start to evaluate | $\bullet^3$ $\sqrt{\dfrac{18}{4}}$ | |
| | $\bullet^4$ find values of $a$ and $b$ | $\bullet^4$ $a = 3, b = 2$ or $\dfrac{3\sqrt{2}}{2}$ | |

**Notes:**

1. Correct answer without working                      award 0/4

2. For $\dfrac{3\sqrt{2}}{2} \rightarrow a = 3, b = \sqrt{2}$ with valid working       award 4/4

3. $\bullet^4$ is only available for simplifying $\sqrt{\dfrac{m}{n}}$ where $m$ is **not** a perfect square

**Commonly Observed Responses:**

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **13.** | | | **Ans:** (2·5, 5·5 ) | | **3** |
| | | | •$^1$ evidence of scaling (match $x$ or $y$ coefficients) | •$^1$ eg $\quad \begin{aligned} 9x - 3y &= 6 \\ x + 3y &= 19 \end{aligned}$ | |
| | | | •$^2$ follow a valid strategy through to produce values for $x$ and $y$ | •$^2$ values for $x$ and $y$ | |
| | | | •$^3$ state correct $x$ and $y$ coordinates of P | •$^3$ $x = 2 \cdot 5, y = 5 \cdot 5$ | |

**Notes:**

1. Correct answer without working                     award 0/3
2. For a solution obtained by guess and check          award 0/3

**Commonly Observed Responses:**

1. For $x = 2 \cdot 5, y = 5 \cdot 5 \rightarrow (5 \cdot 5, 2 \cdot 5)$ with valid working          award 3/3

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **14.** | (a) | | **Ans:** $a = 5$ <br><br> •$^1$ state value of $a$ | •$^1$  5 | **1** |

**Notes:**

1. Evidence may appear on the graph
2. Accept $...(x+5)^2.....$
3. Where **no answer** appears in (a), check (b) for evidence of $a = 5$ eg $8 = (-3+5)^2 + b$

**Commonly Observed Responses:**

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| | (b) | | **Ans:** $b = 4$ <br><br> •$^1$ substitute (−3, 8) into equation <br><br> •$^2$ state value of $b$ | •$^1$  $8 = (-3+5)^2 + b$ <br><br><br> •$^2$  4 | **2** |

**Notes:**

1. Correct answer without working                                                        award 2/2
1. Evidence may appear on the graph
2. An incorrect answer in (a) must be followed through (working must be shown) with the possibility of awarding 2/2.

**Commonly Observed Responses:**

1. For (a) $a = 3$ and (b) $b = 8$   with or without working                award (a) 0/1
                                                                                                            and (b) 0/2

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **15.** | **Ans:** 6·5 <br><br>**Method 1**<br><br>•$^1$ find scale factor<br><br>•$^2$ form equation<br><br><br><br>•$^3$ find $x$<br><br>**Method 2**<br><br>•$^1$ form equation<br><br>•$^2$ start to solve<br><br>•$^3$ find $x$<br><br>**Method 3**<br><br>•$^1$ state ratio<br><br>•$^2$ start to solve<br><br>•$^3$ find $x$<br><br>**Method 4**<br><br>•$^1$ state ratio<br><br>•$^2$ start to solve<br><br><br><br>•$^3$ find $x$ | •$^1$ $\dfrac{5}{7}$ or $\dfrac{7}{5}$<br><br>•$^2$ $(x=)\dfrac{5}{7}(x+2\cdot6)$<br><br>or $\dfrac{7}{5}x = x + 2\cdot6$<br><br>•$^3$ 6·5<br><br><br>•$^1$ $\dfrac{x}{5} = \dfrac{x+2\cdot6}{7}$ or equivalent<br><br>•$^2$ $7x = 5(x+2.6)$ or equivalent<br><br>•$^3$ 6·5<br><br><br>•$^1$ $5{:}2 \equiv x{:}2\cdot6$ stated or implied by<br><br>•$^2$ $2\cdot6 \times \dfrac{5}{2}$<br><br>•$^3$ 6·5<br><br><br>•$^1$ $\dfrac{2}{7}\mathrm{PR} = 2\cdot6$<br><br>•$^2$ $\mathrm{PR} = \dfrac{7}{2}\times2\cdot6 \quad(=9\cdot1)$<br><br>•$^3$ $(9\cdot1 - 2\cdot6 =)\,6\cdot5$ | **3** |

**Notes:**

1. Correct answer without working                                      award 0/3

**Commonly Observed Responses:**

1. $\dfrac{5}{7} = \dfrac{x}{2\cdot6} \rightarrow x = \dfrac{13}{7}$                           award 1/3   ✓×✗

**[END OF MARKING INSTRUCTIONS]**

**Detailed marking instructions for each question**

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| 1. | Ans: 23<br><br>$\bullet^1$ start process<br><br>$\bullet^2$ solution | $\bullet^1$ $18^2 + (-14)^2 + 3^2$<br><br>$\bullet^2$ 23 | 2 |

**Notes:**

1. Correct answer without working                                          award 2/2

**Commonly Observed Responses:**

**No working necessary:**

1. $\sqrt{529}$                                                                     award 1/2 ✓✗
2. $11\cdot 7... \left( eg \ \sqrt{324 - 196 + 9} = \sqrt{137} \right)$                 award 1/2 ✗✓
3. $\sqrt{137}$                                                                    award 0/2
4. $2\cdot 6... \left( eg \ \sqrt{18 - 14 + 3} = \sqrt{7} \right)$                       award 0/2

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **2.** | | | **Ans:** £1369 | | **3** |
| | | | $\bullet^1$ know how to increase by $4\cdot5\%$ | $\bullet^1$ $\times 1\cdot045$ | |
| | | | $\bullet^2$ know how to calculate value after three years | $\bullet^2$ $1200\times1\cdot045^3$ | |
| | | | $\bullet^3$ evaluate to nearest £ | $\bullet^3$ $1369$ | |

**Notes:**

1. Correct answer without working                                          award 3/3

2. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3,
   eg for $1200\times1\cdot45^3 = 3658$, with working                      award 2/3 ✗✓✓

3. Where division is used,
   (a) along with $1\cdot045$, $\bullet^1$ is not available
       eg $1200\div1\cdot045^3 = 1052$                                      award 2/3 ✗✓✓

   (b) along with an incorrect percentage, $\bullet^1$ and $\bullet^2$ are not available
       eg $1200\div0\cdot955^3 = 1378$                                      award 1/3 ✗✗✓

**Commonly Observed Responses:**

**1. No working necessary:**
   (a) $1369\cdot00$                                                        award 3/3
   (b) $1370$ or $1369\cdot40$ or $1369\cdot4$                              award 2/3 ✓✓✗

**2. Working must be shown:**
   (a) $1200\times0\cdot955^3 = 1045$                                       award 2/3 ✗✓✓
   (b) $1200\times0\cdot045 = 54 \rightarrow 1200+3\times54 = 1362$         award 1/3 ✓✗✗
   (c) $1200\times1\cdot045 = 1254$                                         award 1/3 ✓✗✗
   (d) $1200\times1\cdot045\times3 = 3762$                                  award 1/3 ✓✗✗
   (e) $1200\times0\cdot045\times3 = 162$                                   award 0/3

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **3.** | **Ans:** 413m | | **3** |
| | $\bullet^1$ correct substitution into cosine rule | $\bullet^1$ $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147$ | |
| | $\bullet^2$ evaluate $QR^2$ | $\bullet^2$ $170380 \cdot 3$ | |
| | $\bullet^3$ calculate $QR$ | $\bullet^3$ $412 \cdot 77...(m)$ | |

**Notes:**

**1.** Correct answer without working          award 0/3

2.  Accept 412 metres with working          award 3/3

3. Where sine rule is used          award 0/3

4. Disregard errors due to premature rounding provided there is evidence
   (a) $180^2 + 250^2 - 2 \times 180 \times 250 \times (-0 \cdot 84) = 170500 \rightarrow 412 \cdot 9...$          award 3/3
   (b) $180^2 + 250^2 - 2 \times 180 \times 250 \times (-0 \cdot 8) = 166900 \rightarrow 408 \cdot 5...$          award 3/3

5. (a)  407 or 408 (RAD)          award 2/3 ✓×✓
   (b)  394 (GRAD)          award 2/3 ✓×✓

Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15.

**Commonly Observed Responses:**

**Working must be shown:**

1. $\sqrt{180^2 + 250^2} = 308(\cdot 05...)$          award 1/3 ×× ✓

2. (a) $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147 = 170380 \cdot 0... \rightarrow 410$          award 3/3

   (b) $180^2 + 250^2 - 2 \times 180 \times 250 \times \cos 147 \rightarrow 410$          award 2/3 ✓×✓

3. $32400 + 62500 - 75480 \cdot 35... = 19419 \cdot 64... \rightarrow 139(\cdot 35...)$          award 2/3 ✓×✓

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **4.** | **Ans:** $x = -3 \cdot 1,\ x = 0 \cdot 6$<br><br>$\bullet^1$ substitute correctly into quadratic formula<br><br>$\bullet^2$ evaluate discriminant<br><br>$\bullet^3$ calculate both values of $x$ correct to one decimal place | $\bullet^1\ \dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2}$<br><br>$\bullet^2$ 57   (stated or implied by $\bullet^3$)<br><br>$\bullet^3$ $-3 \cdot 1,\ 0 \cdot 6$ | 3 |

**Notes:**

1. Correct answer without working                                              award 0/3

2. The final mark is only available if $b^2 - 4ac > 0$ ; see CORs 2 - 5

3. The final mark is only available when answer requires rounding

**Commonly Observed Responses:**

1. 57   $\left(b^2 - 4ac\right)$                                            award 1/3 ×✓×

2. $\dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2} \rightarrow \dfrac{-5 \pm \sqrt{-7}}{2 \times 2} \rightarrow -1 \cdot 9, -0 \cdot 6$     award 1/3 ✓××
   (Beware: candidate may get $\sqrt{-7}$ then change it to $\sqrt{7}$ )

3. $\dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times (-4)}}{2 \times 2} \rightarrow \dfrac{-5 \pm \sqrt{7}}{2 \times 2} \rightarrow -1 \cdot 9, -0 \cdot 6$     award 2/3 ✓×✓

4. $\dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times 4}}{2 \times 2} \rightarrow \dfrac{-5 \pm \sqrt{-7}}{2 \times 2} \rightarrow -1 \cdot 9, -0 \cdot 6$     award 1/3 ×✓×
   (Beware: candidate may get $\sqrt{-7}$ then change it to $\sqrt{7}$ )

5. $\dfrac{-5 \pm \sqrt{5^2 - 4 \times 2 \times 4}}{2 \times 2} \rightarrow \dfrac{-5 \pm \sqrt{7}}{2 \times 2} \rightarrow -1 \cdot 9, -0 \cdot 6$     award 1/3 ××✓

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **5.** | | | **Ans:** 4200 | | **3** |
| | | | $\bullet^1$ know that $115\% = 4830$ | $\bullet^1$ $115\% = 4830$ | |
| | | | $\bullet^2$ begin valid strategy | $\bullet^2$ $1\% = \dfrac{4830}{115}$ or equivalent | |
| | | | $\bullet^3$ complete calculation within valid strategy | $\bullet^3$ 4200 | |

**Notes:**

1. For 4200 with or without working               award 3/3

2. For 4105 or 4106 (85% of 4830) or 5554 or 5555 (115% of 4830)

    (i)      **and** evidence of $\bullet^1$           award 1/3 ✓××

    (ii)     otherwise                   award 0/3

**Commonly Observed Responses:**

1. $\dfrac{4830}{1\cdot15} = 4200$                              award 3/3

2. $85\% = 4830 \rightarrow 5682$                    award 2/3 ×✓✓

3. $15\% = 4830 \rightarrow 32200$                   award 2/3 ×✓✓

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **6.** | | | **Ans:** 4180mm$^3$ | | **5** |
| | | | $\bullet^1$ know to find difference of two volumes | $\bullet^1$ evidence of difference in two volumes | |
| | | | $\bullet^2$ substitute correctly into formula for volume of large sphere | $\bullet^2$ $\frac{4}{3}\times\pi\times12^3\left(=7238\cdot229\ldots\right)$ | |
| | | | $\bullet^3$ substitute correctly into formula for volume of small sphere | $\bullet^3$ $\frac{4}{3}\times\pi\times9^3\left(=3053\cdot628\ldots\right)$ | |
| | | | $\bullet^4$ carry out all calculations correctly (must involve difference or sum of two volume calculations and include a fraction) | $\bullet^4$ $4184\cdot601$ | |
| | | | $\bullet^5$ round final answer to 3 significant figures and correct units | $\bullet^5$ 4180mm$^3$ | |

**Notes:**

1. Correct answer without working           award 0/5

2. Accept variations in $\pi$

   eg $\frac{4}{3}\times3\cdot14\times12^3-\frac{4}{3}\times3\cdot14\times9^3=4182\cdot48=4180\,\text{mm}^3$

3. In awarding $\bullet^5$
   (a) Intermediate calculations need not be shown

    eg $\frac{4}{3}\times\pi\times12^3-\frac{4}{3}\times\pi\times9^3=4180\,\text{mm}^3$     award 5/5

   (b) Where intermediate calculations are shown, they must involve at least four significant figures

    eg $7238\cdot229\ldots-3053\cdot628\ldots=7240-3050=4190\text{mm}^3$  award 4/5 ✓✓✓✓✗

4. Volume of second sphere may be calculated using volume scale factor

   eg accept $\left(\frac{3}{4}\right)^3\times\frac{4}{3}\times\pi\times12^3$ for the award of $\bullet^3$

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| — see below |||| 

**Commonly Observed Responses:**

**Working must be shown:**

1. (a) $\frac{4}{3}\times\pi\times12^3 - \frac{4}{3}\times\pi\times10\cdot5^3 = (7238\cdot... - 4849\cdot...) = 2390\,\text{mm}^3$     award 4/5 ✓✓✗✓✓

   (b) $\frac{4}{3}\times\pi\times12^3 - \frac{4}{3}\times\pi\times10\cdot5^3 = 7240 - 4850 = 2390\,\text{mm}^3$     award 3/5 ✓✓✗✓✗

2. $\frac{4}{3}\times\pi\times12^3 - \frac{4}{3}\times\pi\times3^3 = 7130\,\text{mm}^3$     award 4/5 ✓✓✗✓✓

3. $\frac{4}{3}\times\pi\times12^3 = 7240\,\text{mm}^3$     award 2/5 ✗✓✗✗✓

4. $\frac{4}{3}\times\pi\times12^3 + \frac{4}{3}\times\pi\times9^3 = 10300\,\text{mm}^3$     award 4/5 ✗✓✓✓✓

5. $\frac{4}{3}\times\pi\times24^3 - \frac{4}{3}\times\pi\times18^3 = 33500\,\text{mm}^3$     award 4/5 ✓✗✓✓✓

6. $\frac{4}{3}\times\pi\times24^3 - \frac{4}{3}\times\pi\times21^3 = 19100\,\text{mm}^3$     award 3/5 ✓✗✗✓✓

7. $\frac{4}{3}\times\pi\times1\cdot5^3 = 14\cdot1\,\text{mm}^3$     award 1/5 ✗✗✗✗✓

8. $\frac{4}{3}\times\pi\times12^2 - \frac{4}{3}\times\pi\times9^2 = 264\,\text{mm}^3$     award 4/5 ✓✗✓✓✓

9. $\frac{4}{3}\times\pi\times12^3 - \frac{4}{3}\times\pi\times9^3 = 1332\pi\,\text{mm}^3$     award 4/5 ✓✓✓✓✗

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **7.** | **Ans: No, with valid reason**<br>**Method 1**<br><br>$\bullet^1$ valid strategy (Converse of Pythagoras' Theorem in correct triangle with correct combination of sides)<br><br>$\bullet^2$ evaluation<br><br>$\bullet^3$ comparison and state conclusion<br>**Method 2**<br><br>$\bullet^1$ valid strategy (Pythagoras' Theorem in correct triangle with correct combination of sides)<br><br>$\bullet^2$ evaluation<br><br>$\bullet^3$ comparison and state conclusion<br>**Method 3**<br><br>$\bullet^1$ valid strategy (correct substitution into cosine rule to find largest angle in correct triangle)<br><br>$\bullet^2$ evaluation<br><br>$\bullet^3$ find angle and state conclusion<br>**Method 4**<br><br>$\bullet^1$ valid strategy (correct substitutions into cosine rule to find angle opposite 6 in triangle A **and** angle opposite 16 in triangle B)<br><br>$\bullet^2$ evaluation of both cos values<br><br>$\bullet^3$ find sum of angles and state conclusion | <br><br>$\bullet^1$ $8^2 + 19^2$ and $22^2$<br><br><br>$\bullet^2$ $8^2 + 19^2 = 425$, $22^2 = 484$<br><br>$\bullet^3$ $8^2 + 19^2 \neq 22^2$; No<br><br><br>$\bullet^1$ $8^2 + 19^2$<br><br><br>$\bullet^2$ length of longest side $= 20 \cdot 6$<br><br>$\bullet^3$ $20 \cdot 6 \neq 22$; No<br><br><br>$\bullet^1$ $\cos x^\circ = \dfrac{8^2 + 19^2 - 22^2}{2 \times 8 \times 19}$<br><br><br>$\bullet^2$ $\cos x^\circ = -0 \cdot 194$<br><br>$\bullet^3$ $(x =) \, 101 \cdot 2$; No<br><br><br>$\bullet^1$ $\cos x^\circ = \dfrac{8^2 + 7^2 - 6^2}{2 \times 8 \times 7}$<br><br>and $\cos y^\circ = \dfrac{7^2 + 19^2 - 16^2}{2 \times 7 \times 19}$<br><br>$\bullet^2$ $\cos x^\circ = 0 \cdot 6875$ and $\cos y^\circ = 0 \cdot 5789$<br><br>$\bullet^3$ (sum $=) \, 101 \cdot 2$; No | **3** |

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|

**Notes:**

1. In Method 1 $\bullet^3$ is **not** available when evaluations at $\bullet^2$ have **not** been carried out

   eg $8^2 + 19^2 = 64 + 361$ , $22^2 = 484$; $8^2 + 19^2 \neq 22^2$; No        award 1/3 ✓✗✗

   $8^2 + 19^2 = 64 + 361 = 425$, $22^2 = 484$; $8^2 + 19^2 \neq 22^2$; No     award 3/3

2. Where the wrong triangle is chosen, $\bullet^2$ is only available for consistent application of Pythagoras or cosine rule; see CORs 2 and 3

**Commonly Observed Responses:**

1. $8^2 + 19^2 = 64 + 361 = 425, 22^2 = 484$; $8^2 + 19^2 < 22^2$; No      award 3/3

2. $7^2 + 16^2 = 305, 19^2 = 361$; $7^2 + 16^2 \neq 19^2$; No      award 2/3 ✗✓✓

3. $7^2 + 19^2 = 410, 16^2 = 256$; $7^2 + 19^2 \neq 16^2$; No      award 1/3 ✗✗✓

4. $8^2 + 22^2 = 548, 19^2 = 361$; $8^2 + 22^2 \neq 19^2$; No      award 2/3 ✗✓✓

5. (a) $8^2 + 19^2 = 425, 22^2 = 484$; The **square of the hypotenuse** is not equal to the sum of the squares of the other two sides; No      award 3/3

   (b) $8^2 + 19^2 = 425, 22^2 = 484$; The **hypotenuse** is not equal to the sum of the squares of the other two sides; No      award 2/3 ✓✓✗

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **8.** | (a) | | **Ans: d - c** | | **1** |
| | | | $\bullet^1$ answer | $\bullet^1$ **d - c** or equivalent | |

**Notes:**

1. Accept **-c + d** or **d + -c**
2. Accept **D - C** as bad form

**Commonly Observed Responses:**

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| | (b) | | **Ans:** $\dfrac{3}{2}\mathbf{d} - \dfrac{1}{2}\mathbf{c}$ | | **2** |
| | | | $\bullet^1$ valid pathway | $\bullet^1$ $\overrightarrow{TP} + \dfrac{1}{2}\overrightarrow{PR}$ or $\overrightarrow{TQ} + \overrightarrow{QR} + \dfrac{1}{2}\overrightarrow{RP}$ | |
| | | | $\bullet^2$ correct simplified expression | $\bullet^2$ $\dfrac{3}{2}\mathbf{d} - \dfrac{1}{2}\mathbf{c}$ or equivalent | |

**Notes:**

**1.** Correct answer without working                                      award 2/2

2. Accept $\dfrac{3}{2}\mathbf{D} - \dfrac{1}{2}\mathbf{C}$

3. $\overrightarrow{TP} + \overrightarrow{PV}$ or $\overrightarrow{TQ} + \overrightarrow{QR} + \overrightarrow{RV}$ alone is not enough for the award of $\bullet^1$

4. For the award of $\bullet^1$

  (a) accept $\mathbf{d} + \dfrac{1}{2}\overrightarrow{PR}$ but **not** $\mathbf{d} + \overrightarrow{PV}$

  (b) accept $2\mathbf{d} - \mathbf{c} + \dfrac{1}{2}\overrightarrow{RP}$ but **not** $2\mathbf{d} - \mathbf{c} + \overrightarrow{RV}$

  (c) accept $\overrightarrow{PV} = \dfrac{1}{2}(\mathbf{d} - \mathbf{c})$ but **not** $\dfrac{1}{2}(\mathbf{d} - \mathbf{c})$ alone

  (d) accept $\overrightarrow{RV} = \dfrac{1}{2}(\mathbf{c} - \mathbf{d})$ but **not** $\dfrac{1}{2}(\mathbf{c} - \mathbf{d})$ alone

**Commonly Observed Responses:**

1. $\dfrac{1}{2}(3\mathbf{d} - \mathbf{c})$                                                 award 2/2

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **9.** | (a) | | **Ans:** $(2x-5)(2x+5)$ <br><br> $\bullet^1$ factorise | $\bullet^1$ $(2x-5)(2x+5)$ | **1** |

**Notes:**

**Commonly Observed Responses:**

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| | (b) | | **Ans:** $\dfrac{2x+5}{x+2}$ <br><br> $\bullet^1$ start to factorise <br><br> $\bullet^2$ complete factorising <br><br> $\bullet^3$ simplify | $\bullet^1$ $(2x\ 5)(x\ 2)$ <br><br> $\bullet^2$ $(2x-5)(x+2)$ <br><br> $\bullet^3$ $\dfrac{2x+5}{x+2}$ | **3** |

**Notes:**

1.  Correct answer without working — award 3/3

2.  For $(2x\ 10)(x\ 1)$ or $(2x\ 2)(x\ 5)$ etc — award 1/3 ✓××

3.  For subsequent incorrect working, the final mark is not available

    eg $\dfrac{2\cancel{x}+5}{\cancel{x}+2}=\dfrac{7}{3}$ — award 2/3 ✓✓×

4.  $\bullet^3$ is only available when both the numerator and denominator have at least two factors

**Commonly Observed Responses:**

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **10.** | | | **Ans: 9·9 kilometres**<br><br>$\bullet^1$ calculate size of angles DEF and DFE<br><br>$\bullet^2$ correct substitution into sine rule<br><br>$\bullet^3$ rearrange formula<br><br>$\bullet^4$ calculate DF | $\bullet^1$ 40 and 104<br><br>$\bullet^2 \ \dfrac{DF}{\sin 40} = \dfrac{15}{\sin 104}$<br><br>$\bullet^3 \ \dfrac{15 \times \sin 40}{\sin 104}$<br><br>$\bullet^4$ 9·9(36...) | **4** |

**Notes:**

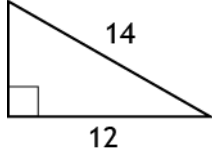1. Correct answer without working                                    award 0/4

2. Accept a final answer of 10, with working                         award 4/4

3. $\bullet^1$ may be awarded for sizes of angles DEF and DFE marked on the diagram

4. Where incorrect sizes are used for angles DEF and DFE
   (a)  with prior evidence of angle sizes (marked on diagram or clearly attached to **named** angles**)**, marks $\bullet^2$, $\bullet^3$ and $\bullet^4$ are available
   (b)  **without** prior evidence of angle sizes, only marks $\bullet^3$ and $\bullet^4$ are available

5. **BEWARE** $\dfrac{DF}{\sin 40} = \dfrac{15}{\sin 76} \rightarrow 9\cdot 9$
   (a)  with prior evidence of DEF = 40 and DFE = 76          award 3/4  ×✓✓✓
   (b)  **without** prior evidence of sizes of angles DEF and DFE   award 2/4  ××✓✓

6. Disregard errors due to premature rounding provided there is evidence

7. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15
   (a)  $-34\cdot 7\ldots$ (RAD)
   (b)  $8\cdot 8\ldots$ (GRAD)

**Commonly Observed Responses:**

1. $\dfrac{DF}{\sin 36} = \dfrac{15}{\sin 90} \rightarrow 8\cdot 8$
   (a) with prior evidence of sizes of angles DEF and DFE marks    award 3/4  ×✓✓✓
   (b) **without** prior evidence of sizes of angles DEF and DFE    award 2/4  ××✓✓

2. $\dfrac{DF}{\sin 230} = \dfrac{15}{\sin 126} \rightarrow -14\cdot 2$                award 2/4 ××✓✓

3. $\dfrac{DF}{40} = \dfrac{15}{104} \rightarrow 5\cdot 769\ldots\ldots$                award 1/4 ✓×××

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **11.** | **Ans:** $\dfrac{3}{5}$ or $0\cdot6$ <br><br> $\bullet^1$ isolate term in $y$ or divide throughout by 5 <br><br><br> $\bullet^2$ state gradient explicitly | <br><br> $\bullet^1$ $-5y=-3x...$ or $3x...=5y$ or <br> or $\dfrac{3x}{5}-\dfrac{5y}{5}-\dfrac{10}{5}=0$ <br><br> $\bullet^2$ $\dfrac{3}{5}$ or $0\cdot6$ | 2 |

**Notes:**

1. Correct answer without working                                award 2/2

2. Do not accept $x=\dfrac{3}{5}$ or $y=\dfrac{3}{5}$ for the award of $\bullet^2$

3. Where gradient formula is used with two points which
   (a) lie on the line $3x-5y+10=0$,
        award $\bullet^1$ for correct substitution into gradient formula
        award $\bullet^2$ for correct calculation of gradient
   (b) do not lie on the line $3x-5y+10=0$, award 0/2

**Commonly Observed Responses:**

1. $\dfrac{3}{5}x$ or $0\cdot6x$   (with working)                       award 1/2 ✓✗

| Question | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|
| **12.** | **Ans:** $x^{-\frac{1}{3}}$ <br><br> $\bullet^1$ apply $\sqrt[n]{x^m} = x^{\frac{m}{n}}$ <br><br><br> $\bullet^2$ apply $\dfrac{1}{x^n} = x^{-n}$ | $\bullet^1$ $\dfrac{1}{x^{\frac{1}{3}}}$ stated or implied by $\bullet^2$ <br><br><br> $\bullet^2$ $x^{-\frac{1}{3}}$ | **2** |

**Notes:**

1. Correct answer without working                                    award 2/2

2. Accept $x^{\frac{1}{3}}$ for $\bullet^1$

3. Where a number or letter (excluding $n$) other than $x$ is used

   eg $a^{-\frac{1}{3}}$ or $8^{-\frac{1}{3}}$                                                                  award 1/2

        $n^{-\frac{1}{3}}$                                                                                award 0/2

**Commonly Observed Responses:**

1. $n = -\dfrac{1}{3}$                                                                        award 2/2

2. $-x^{\frac{1}{3}}$                                                                         award 1/2 ✓✗

3. $x^{-3}$                                                                            award 1/2 ✗✓

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **13.** | | | **Ans:** $42 \cdot 4$ **centimetres** <br><br> •$^1$ marshal facts and recognise right-angled triangle <br><br><br> •$^2$ consistent Pythagoras statement <br><br> •$^3$ calculation of $x$ <br><br> •$^4$ find height of the logo |  <br> •$^1$ <br><br> •$^2$ $\quad x^2 = 14^2 - 12^2$ <br><br> •$^3$ $\quad 7 \cdot 2$ <br><br> •$^4$ $\quad 42 \cdot 4$ | 4 |

**Notes:**

1. Correct answer without working             award 0/4

2. The final mark is for doubling the result of a **Pythagoras (or trig.)** calculation and then adding 28

3. In the absence of a diagram accept $x^2 = 14^2 - 12^2$ as evidence for the award of •$^1$ and •$^2$

4. **BEWARE**
   Where a diagram is shown, working must be consistent with the diagram.
   •$^2$ is not available for an **<u>incorrect</u>** diagram leading to $\quad x^2 = 14^2 - 12^2$

5. Disregard errors due to premature rounding provided there is evidence

**Commonly Observed Responses:**

1. For $x^2 = 14^2 + 12^2 \rightarrow x = 18 \cdot 4$   height $= 64 \cdot 8...$ or $64 \cdot 9$
   (a) working inconsistent with correct diagram        award 3/4 ✓✗✓✓
   (b) working consistent with candidate's diagram      award 3/4 ✗✓✓✓
         (cosine rule may be used to calculate $x$)
   (c) no diagram                                             award 2/4 ✗✗✓✓

2. For $x^2 = 24^2 - 14^2 \rightarrow x = 19 \cdot 4...$   height $= 66 \cdot 9...$ or $67$
   (a) working consistent with candidate's diagram      award 3/4 ✗✓✓✓
   (b) no diagram or working not consistent with candidate's diagram                                       award 2/4 ✗✗✓✓

3. For $x^2 = 24^2 + 14^2 \rightarrow x = 27 \cdot 8...$   height $= 83 \cdot 5...$ or $83 \cdot 6$
   (a) working consistent with candidate's diagram      award 3/4 ✗✓✓✓
         (cosine rule may be used to calculate $x$)
   (b) no diagram or working not consistent with candidate's diagram                                       award 2/4 ✗✗✓✓

| Question | | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **14.** | | | **Ans:** $282^{\circ}$ <br><br> **Method 1** <br><br> $\bullet^1$ expression for arc length <br><br> $\bullet^2$ know how to find angle <br><br> $\bullet^3$ calculate angle <br><br> **Method 2** <br><br> $\bullet^1$ arc length: circumference ratio <br><br> $\bullet^2$ know how to find angle <br><br> $\bullet^3$ calculate angle | <br><br> $\bullet^1\ \dfrac{angle}{360}\times\pi\times12\cdot8$ <br><br> $\bullet^2\ \dfrac{31\cdot5\times360}{\pi\times12\cdot8}$ <br><br> $\bullet^3\ \ 282(\cdot\ )$ <br><br><br> $\bullet^1\ \dfrac{31\cdot5}{\pi\times12\cdot8}\ \ (=0\cdot78\ldots)$ <br><br> $\bullet^2\ \dfrac{31\cdot5\times360}{\pi\times12\cdot8}$ <br><br> $\bullet^3\ \ 282(\cdot\ )$ | **3** |

**Notes:**

1. Correct answer without working                                        award 0/3

2. Accept variations in $\pi$

3. Premature rounding of $\dfrac{31\cdot5}{\pi\times12\cdot8}$ must be to at least 2 decimal places

4. For the award of $\bullet^3$, the calculation must involve a division by a product. <br> The calculation must include $31\cdot5$, $\pi$ , 360 and the candidate's chosen diameter or radius

5. For subsequent incorrect working, the final mark is not available <br> eg $360-282=78$                                          award 2/3 ✓✓✗

**Commonly Observed Responses:**

1. For $\dfrac{31\cdot5\times360}{\pi\times6\cdot4}=564$                           award 2/3     ✗✓✓

2. For $\dfrac{31\cdot5\times360}{\pi\times6\cdot4^2}=88\cdot1\ldots$                      award 2/3     ✗✓✓

3. For $\dfrac{31\cdot5}{360}\times\pi\times12\cdot8=3\cdot518\ldots$                 award 0/3

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| **15.** | (a) | | **Ans: 51·5 metres** | | 1 |
| | | | $\bullet^1$ calculate height | $\bullet^1$ 51·5 | |

**Notes:**

1. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15

    (a)   18·1... (RAD)
    (b)   53·5... (GRAD)

**Commonly Observed Responses:**

1.    51·5, 308·5                                  award 0/1

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| | (b) | | **Ans: 17 metres** | | 1 |
| | | | $\bullet^1$ calculate minimum height | $\bullet^1$ 17 | |

**Notes:**
1. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15

    (a)   26·2... (RAD)
    (b)   18·1... (GRAD)

**Commonly Observed Responses:**

| | Question | | Generic scheme | Illustrative scheme | Max mark |
|---|---|---|---|---|---|
| | (c) | | **Ans: 24·1° and 335·9°** | | 4 |
| | | | $\bullet^1$ substitute 61 correctly into equation | $\bullet^1$ $61 = 40 + 23\cos x$ | |
| | | | $\bullet^2$ calculate $\cos x$ | $\bullet^2$ $\cos x = \dfrac{21}{23}$ | |
| | | | $\bullet^3$ calculate value of $x$ | $\bullet^3$ $24(\cdot 07...)$ | |
| | | | $\bullet^4$ calculate 2nd value of $x$ | $\bullet^4$ $335(\cdot 92...)$ | |

| Question | Generic scheme | Illustrative scheme | Max mark |
|----------|----------------|---------------------|----------|

**Notes:**

1. Correct answers
   (a) without working — award 1/4 ✗✗✗✓
   (b) by repeated substitution — award 1/4 ✗✗✗✓

2. Accept 24 and 336 with valid working

3. Disregard errors due to premature rounding provided there is evidence

4. Do not penalise omission of degree sign throughout the question

5. Inappropriate use of RAD or GRAD should only be penalised once in either Q3, 10 or 15
   (a)  $0 \cdot 418\ldots, 359 \cdot 5\ldots$  (RAD)
   (b)  $26 \cdot 7\ldots$ , $333 \cdot 3\ldots$  (GRAD)

**Commonly Observed Responses:**

1. $61 = 40 + 23\cos x \rightarrow 61 = 63\cos x \rightarrow \cos x = \dfrac{61}{63} \rightarrow x = 14 \cdot 5,\ 345 \cdot 5$ — award 3/4 ✓✗✓✓

2. $\cos x = \dfrac{-2}{60} \rightarrow x = 91 \cdot 9,\ 268 \cdot 1$ — award 2/4 ✗✗✓✓

**[END OF MARKING INSTRUCTIONS]**