Topic 5 Part 4 *[241 marks]*

1a. *[2 marks]*

Markscheme

$4y = -x - 34$ or similar rearrangement ***(M1)***

Gradient $= -\frac{1}{4}$ ***(A1)*** ***(C2)***

Examiners report

The omission of the negative sign was a common fault.

1b. *[2 marks]*

Markscheme

$m = 4$ ***(A1)*****(ft)*****(A1)*****(ft)*** ***(C2)***

Note: ***(A1)*** Change of sign
(A1) Use of reciprocal

[2 marks]

Examiners report

Most candidates managed to answer this correctly from their (a).

1c. *[2 marks]*

Markscheme

Reasonable attempt to solve equations simultaneously ***(M1)***

$(-2, -8)$ ***(A1)*****(ft)** ***(C2)***

Note: Accept
$x = -2$
$y = -8$. Award ***(A0)*** if brackets not included.

[2 marks]

Examiners report

This part proved challenging for the majority. Once again, the use of the GDC was expected.

2a. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *applies in this question.*

$\text{VM}^2 = 13^2 - 5^2$ ***(M1)***

UP
$= 12$ cm ***(A1)*** ***(C2)***

[2 marks]

Examiners report

This question was poorly answered by many of the candidates. Pythagoras was improperly applied and candidates were unable to identify right angled triangles.

2b. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *applies in this question.*

$h^2 = 12^2 - 5^2$ *(or equivalent)* ***(M1)***

UP
$= 10.9\text{ cm}$ ***(A1)*****(ft)** ***(C2)***

[2 marks]

Examiners report

This question was poorly answered by many of the candidates. Pythagoras was improperly applied and candidates were unable to identify right angled triangles.

3a. *[3 marks]*

Markscheme

$\text{AC}^2 = 9^2 + 4.2^2 - 2 \times 9 \times 4.2 \times \cos 95^\circ$ ***(M1)(A1)***
$\text{AC} = 10.3\text{ m}$ ***(A1)(G2)***

Note: ***(M1)*** for correct substituted formula and ***(A1)*** for correct substitution. If radians used answer is 6.59. Award at most ***(M1)(A1)(A0)***.

Note: The final ***A1*** is only awarded if the correct units are present; only penalize once for the lack of units or incorrect units.

Examiners report

It could have been written that the diagram was representing the plan of the sandbox. However, examiner's comments did not find this lack of information an obstacle for the candidates.

Overall the lengths of AC and AB were well done. Sine rule and cosine rule were in general well used. To find the length of AB many students used correctly right- angled trigonometry. The area of the sandbox was in general well done though some students did not gain the final mark due to premature rounding or for not showing the unrounded answer. The volume of the prism was poorly answered by the majority of the students. Most of the students did not use the correct formula. Very few candidates noticed that the value
40 was given in cm. It was good to see very few students losing marks for having their GDC setting in radians.

3b. *[4 marks]*

Markscheme

(i)

$\hat{BCA} = 25°$ ***(A1)***

(ii)

$\frac{AB}{\sin 25°} = \frac{10.258...}{\sin 130°}$ ***(M1)(A1)***

$AB = 5.66\text{ m}$ ***(A1)*****(ft)*****(G2)***

Note: ***(M1)*** for correct substituted formula and ***(A1)*** for correct substitution. ***(A1)*** for correct answer.

Follow through with angle B$\hat{C}$A and their AC. Allow AB = 5.68 if AC = 10.3 used. If radians used answer is 0.938 (unreasonable answer). Award at most ***(M1)(A1)(A0)*****(ft)**.

OR

Using that ABC is isosceles

$\cos 25° = \frac{\frac{1}{2} \times 10.258...}{AB}$ (*or equivalent*) ***(A1)(M1)*****(ft)**

$AB = 5.66\text{ m}$ ***(A1)*****(ft)*****(G2)***

Note: ***(A1)*** for $\frac{1}{2}$ of their AB seen, ***(M1)*** for correct trigonometric ratio and correct substitution, ***(A1)*** for correct answer. If $\frac{1}{2}$AB seen and correct answer is given award ***(A1)(G1)***. Allow AB = 5.68 if AC = 10.3 used. If radians used answer is 3.32. Award ***(A1)(M1)(A1)*****(ft)**. If sin 65 and radians used answer is 3.99. Award ***(A1)(M1)(A1)*****(ft)**.

Note: The final ***A1*** is only awarded in (ii) if the correct units are present; only penalize once for the lack of units or incorrect units.

Examiners report

It could have been written that the diagram was representing the plan of the sandbox. However, examiner's comments did not find this lack of information an obstacle for the candidates.

Overall the lengths of AC and AB were well done. Sine rule and cosine rule were in general well used. To find the length of AB many students used correctly right- angled trigonometry. The area of the sandbox was in general well done though some students did not gain the final mark due to premature rounding or for not showing the unrounded answer. The volume of the prism was poorly answered by the majority of the students. Most of the students did not use the correct formula. Very few candidates noticed that the value 40 was given in cm. It was good to see very few students losing marks for having their GDC setting in radians.

3c. *[4 marks]*

Markscheme

Area

$= \frac{1}{2} \times 9 \times 4.2 \times \sin 95° + \frac{1}{2} \times (5.6592...)^2 \times \sin 130°$ ***(M1)(M1)*****(ft)*****(M1)***

$= 31.095... = 31.1\text{ m}^2$ (*correct to 3 s.f.*) ***(A1)(AG)***

Note: ***(M1)(M1)*** each for correct substitution in the formula of the area of each triangle, ***(M1)*** for adding both areas. ***(A1)*** for unrounded answer. Follow through with their length of AB but last mark is lost if they do not reach the correct answer.

Examiners report

It could have been written that the diagram was representing the plan of the sandbox. However, examiner's comments did not find this lack of information an obstacle for the candidates.

Overall the lengths of AC and AB were well done. Sine rule and cosine rule were in general well used. To find the length of AB many students used correctly right- angled trigonometry. The area of the sandbox was in general well done though some students did not gain the final mark due to premature rounding or for not showing the unrounded answer. The volume of the prism was poorly answered by the majority of the students. Most of the students did not use the correct formula. Very few candidates noticed that the value
40 was given in cm. It was good to see very few students losing marks for having their GDC setting in radians.

3d. *[3 marks]*

Markscheme

Volume of sand
$= \frac{1}{3}(31.09\ldots \times 0.4)$ ***(M1)(M1)***

$= 4.15\ \text{m}^3$ ***(A1)(G2)***

Note: ***(M1)*** for correct formula of volume of prism and for correct substitution, ***(M1)*** for multiplying by $\frac{1}{3}$ and last ***(A1)*** for correct answer only.

Note: The final ***A1*** is only awarded if the correct units are present; only penalize once for the lack of units or incorrect units.

Examiners report

It could have been written that the diagram was representing the plan of the sandbox. However, examiner's comments did not find this lack of information an obstacle for the candidates.

Overall the lengths of AC and AB were well done. Sine rule and cosine rule were in general well used. To find the length of AB many students used correctly right- angled trigonometry. The area of the sandbox was in general well done though some students did not gain the final mark due to premature rounding or for not showing the unrounded answer. The volume of the prism was poorly answered by the majority of the students. Most of the students did not use the correct formula. Very few candidates noticed that the value
40 was given in cm. It was good to see very few students losing marks for having their GDC setting in radians.

4a. *[3 marks]*

Markscheme

(i)
$y = 0$ ***(A1)***

(ii)
$(0, -2)$ ***(A1)(A1)***

Note: Award ***(A1)(A0)*** if brackets missing.

OR

$x = 0, y = -2$ ***(A1)(A1)***

Note: If coordinates reversed award ***(A0)(A1)*****(ft)**. Two coordinates must be given.

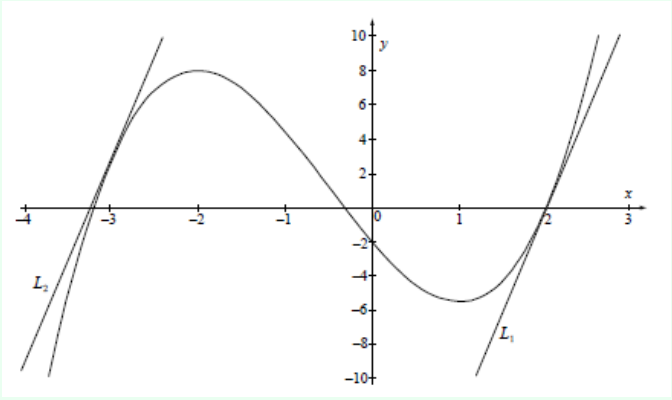
[3 marks]

Examiners report

Many candidates managed to gain good marks in this question as they were able to answer the first three parts of the question. Good sketches were drawn with the required information shown on them. Very few candidates did not recognise the notation $\frac{dy}{dx}$ but they showed that they knew how to differentiate as in (d)(i) they found the derivative to show that the gradient of L_1 was
12. Candidates found it difficult to find the other
x for which the derivative was
12. However, some could draw both tangents without having found this value of
x . In general, tangents were not well drawn. The last part question did act as a discriminating question. However, those candidates that had the function drawn either in their GDC or on paper recognised that at
$x = -2$ there was a maximum and so wrote down the correct equation of the tangent at that point.

4b. *[4 marks]*

Markscheme



(A4)

Notes: ***(A1)*** for appropriate window. Some indication of scale on the
x-axis must be present (for example ticks). Labels not required. ***(A1)*** for smooth curve and shape, ***(A1)*** for maximum and minimum in approximately correct position, ***(A1)*** for
x and
y intercepts found in (a) in approximately correct position.

[4 marks]

Examiners report

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x . In general, tangents were not well drawn. The last part question did act as a discriminating question. However, those candidates that had the function drawn either in their GDC or on paper recognised that at
$x = -2$ there was a maximum and so wrote down the correct equation of the tangent at that point.

4c. *[3 marks]*

Markscheme

$\frac{dy}{dx} = 3x^2 + 3x - 6$ ***(A1)(A1)(A1)***

Note: ***(A1)*** for each correct term. Award ***(A1)(A1)(A0)*** at most if any other term is present.

[3 marks]

Examiners report

Many candidates managed to gain good marks in this question as they were able to answer the first three parts of the question. Good sketches were drawn with the required information shown on them. Very few candidates did not recognise the notation $\frac{dy}{dx}$ but they showed that they knew how to differentiate as in (d)(i) they found the derivative to show that the gradient of L_1 was 12. Candidates found it difficult to find the other x for which the derivative was 12. However, some could draw both tangents without having found this value of x. In general, tangents were not well drawn. The last part question did act as a discriminating question. However, those candidates that had the function drawn either in their GDC or on paper recognised that at $x = -2$ there was a maximum and so wrote down the correct equation of the tangent at that point.

4d. *[8 marks]*

Markscheme

(i)

$3 \times 4 + 3 \times 2 - 6 = 12$ ***(M1)(A1)(AG)***

Note: ***(M1)*** for using the derivative and substituting $x = 2$. ***(A1)*** for correct (and clear) substitution. The 12 must be seen.

(ii) Gradient of L_2 is 12 (can be implied) ***(A1)***

$3x^2 + 3x - 6 = 12$ ***(M1)***

$x = -3$ ***(A1)(G2)***

Note: ***(M1)*** for equating the derivative to 12 or showing a sketch of the derivative together with a line at $y = 12$ or a table of values showing the 12 in the derivative column.

(iii) ***(A1)*** for L_1 correctly drawn at approx the correct point ***(A1)***

(A1) for L_2 correctly drawn at approx the correct point ***(A1)***

(A1) for 2 parallel lines ***(A1)***

Note: If lines are not labelled award at most ***(A1)(A1)(A0)***. Do not accept 2 horizontal or 2 vertical parallel lines.

[8 marks]

Examiners report

Many candidates managed to gain good marks in this question as they were able to answer the first three parts of the question. Good sketches were drawn with the required information shown on them. Very few candidates did not recognise the notation $\frac{dy}{dx}$ but they showed that they knew how to differentiate as in (d)(i) they found the derivative to show that the gradient of L_1 was 12. Candidates found it difficult to find the other x for which the derivative was 12. However, some could draw both tangents without having found this value of x. In general, tangents were not well drawn. The last part question did act as a discriminating question. However, those candidates that had the function drawn either in their GDC or on paper recognised that at $x = -2$ there was a maximum and so wrote down the correct equation of the tangent at that point.

4e. *[5 marks]*

Markscheme

(i)

$b = 1$ ***(G2)***

(ii) The curve is decreasing. ***(A1)***

Note: Accept any valid description.

(iii)

$y = 8$ ***(A1)(A1)(G2)***

Note: ***(A1)*** for "$y =$ a constant", ***(A1)*** for 8.

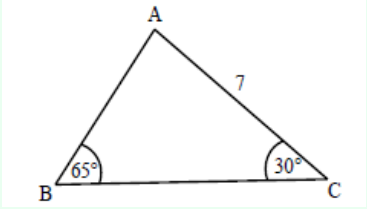
[5 marks]

Examiners report

Many candidates managed to gain good marks in this question as they were able to answer the first three parts of the question. Good sketches were drawn with the required information shown on them. Very few candidates did not recognise the notation $\frac{dy}{dx}$ but they showed that they knew how to differentiate as in (d)(i) they found the derivative to show that the gradient of L_1 was 12. Candidates found it difficult to find the other x for which the derivative was 12. However, some could draw both tangents without having found this value of x. In general, tangents were not well drawn. The last part question did act as a discriminating question. However, those candidates that had the function drawn either in their GDC or on paper recognised that at $x = -2$ there was a maximum and so wrote down the correct equation of the tangent at that point.

5a. *[1 mark]*

Markscheme



(A1) ***(C1)***

Note: ***(A1)*** for fully labelled sketch.

[1 mark]

Examiners report

The triangle was drawn correctly by most and a majority correctly found the length of AB - a few did not write down the units (cm) and so lost a Unit penalty mark. There was still a significant number who tried to use right-angled trigonometry to find the length.

Finding the area of the triangle was mixed with many again assuming the existence of a right angle. Some candidates had their calculators in radian mode rather than degree mode.

5b. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *may apply in this question.*

$\frac{AB}{\sin 30} = \frac{7}{\sin 65}$ ***(M1)***

(UP)

$AB = 3.86$ cm ***(A1)*****(ft)** ***(C2)***

Note: ***(M1)*** for use of sine rule with correct values substituted.

[2 marks]

Examiners report

The triangle was drawn correctly by most and a majority correctly found the length of AB - a few did not write down the units (cm) and so lost a Unit penalty mark. There was still a significant number who tried to use right-angled trigonometry to find the length.

Finding the area of the triangle was mixed with many again assuming the existence of a right angle. Some candidates had their calculators in radian mode rather than degree mode.

5c. *[3 marks]*

Markscheme

Unit penalty ***(UP)*** *may apply in this question.*

Angle $BAC = 85°$ ***(A1)***

Area $= \frac{1}{2} \times 7 \times 3.86 \times \sin 85°$ ***(M1)***

(UP)

$= 13.5$ cm^2 ***(A1)*****(ft)** ***(C3)***

[3 marks]

Examiners report

The triangle was drawn correctly by most and a majority correctly found the length of AB - a few did not write down the units (cm) and so lost a Unit penalty mark. There was still a significant number who tried to use right-angled trigonometry to find the length.

Finding the area of the triangle was mixed with many again assuming the existence of a right angle. Some candidates had their calculators in radian mode rather than degree mode.

6a. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *may apply in this question.*

Distance $= \pi \times 500 + 2 \times 750$ ***(M1)***

(UP)

$= 3070$ m ***(A1)*** ***(C2)***

[2 marks]

Examiners report

Candidates generally answered part (a) well. A usual mistake was taking
500 as the radius. Some candidates worked out the area rather than the circumference. A good number of candidates correctly answered part (b). Others seemed to get lost in the conversion with multiplication by
3600 and not multiplying by
1000 being common errors. Again follow through marks could be awarded from the candidate's answer to part (a) provided working was shown.

6b. *[4 marks]*

Markscheme

*Unit penalty **(UP)** may apply in this question.*

$140\ \text{kmh}^{-1} = \frac{140\times1000}{60\times60}\ \text{ms}^{-1}$ ***(M1)***

$= 38.9\ \text{ms}^{-1}$ ***(A1)***

$\text{Time} = \frac{3070}{38.889}$ ***(M1)***

(UP)
$= 78.9$ seconds *(accept*
79.0 *seconds)* ***(A1)*****(ft)** ***(C4)***

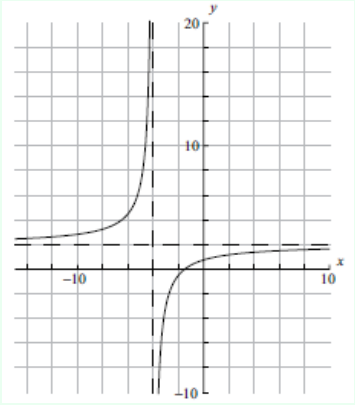
[4 marks]

Examiners report

Candidates generally answered part (a) well. A usual mistake was taking
500 as the radius. Some candidates worked out the area rather than the circumference. A good number of candidates correctly answered part (b). Others seemed to get lost in the conversion with multiplication by
3600 and not multiplying by
1000 being common errors. Again follow through marks could be awarded from the candidate's answer to part (a) provided working was shown.

7a. *[6 marks]*

Markscheme



(A6)

Notes: ***(A1)*** for labels and some idea of scale.
(A1) for
x-intercept seen, ***(A1)*** for
y-intercept seen in roughly the correct places (coordinates not required).
(A1) for vertical asymptote seen, ***(A1)*** for horizontal asymptote seen in roughly the correct places (equations of the lines not required).
(A1) for correct general shape.

[6 marks]

Examiners report

This was not very well done. The graph was often correct but was so small that it was difficult to check if axes intercepts were correct or not. Often the vertical asymptote looked as if it were joined to the rest of the graph. Very few of the candidates put a scale and/or labels on their axes.

7b. *[2 marks]*

Markscheme

$x = -4$ ***(A1)(A1)*(ft)**

Note: ***(A1)*** for $x =$, ***(A1)*(ft)** for -4.

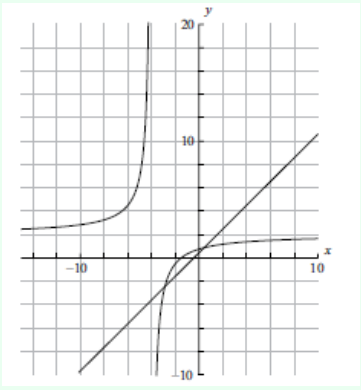
[2 marks]

Examiners report

Reasonably well done. Some put $y = -4$ while others omitted the minus sign.

7c. *[2 marks]*

Markscheme



(A1)(A1)

Note: ***(A1)*** for correct axis intercepts, ***(A1)*** for straight line

[2 marks]

Examiners report

Fairly well done – but once again too small to check the axes intercepts properly. Also, many candidates did not appear to have a ruler to draw the straight line.

7d. *[3 marks]*

Markscheme

$(-2.85078, -2.35078)$ OR
$(0.35078, 0.85078)$ ***(G1)(G1)(A1)*(ft)**

Notes: ***(A1)*** for x-coordinate, ***(A1)*** for y-coordinate, ***(A1)*(ft)** for correct accuracy. Brackets required. If brackets not used award ***(G1)(G0)(A1)*(ft)**.
Accept
$x = -2.85078$,
$y = -2.35078$ or
$x = 0.35078$,
$y = 0.85078$.

[3 marks]

Examiners report

Well done.

7e. *[1 mark]*

Markscheme

gradient $= 1$ ***(A1)***

[1 mark]

Examiners report

Most could find the gradient of the line.

7f. *[3 marks]*

Markscheme

gradient of perpendicular $= -1$ ***(A1)*****(ft)**

(can be implied in the next step)

$y = mx + c$

$-3 = -1 \times -2 + c$ ***(M1)***

$c = -5$

$y = -x - 5$ ***(A1)*****(ft)*****(G2)***

OR

$y + 3 = -(x + 2)$ ***(M1)******(A1)*****(ft)*****(G2)***

Note: Award ***(G2)*** for correct answer with no working at all but ***(A1)******(G1)*** if the gradient is mentioned as -1 then correct answer with no further working.

[3 marks]

Examiners report

Many forgot to find the gradient of the perpendicular line. Others had problems with the equation of a line in general.

8a. *[1 mark]*

Markscheme

$50b + 20c = 260$ ***(A1)***

[1 mark]

Examiners report

Most candidates managed to write down the equation.

8b. *[1 mark]*

Markscheme

$12b + 6c = 66$ ***(A1)***

[1 mark]

Examiners report

Most candidates managed to write down the equation.

8c. *[2 marks]*

Markscheme

Solve to get
$b = 4$ ***(M1)(A1)*****(ft)*****(G2)***

Note: ***(M1)*** for attempting to solve the equations simultaneously.

[2 marks]

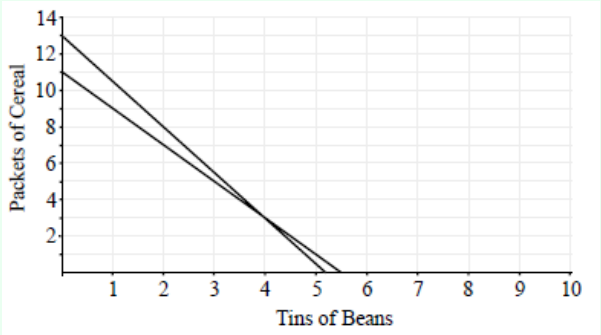
Examiners report

Many managed to find the correct answer and the others tried their best but made some mistake in the process.

8d. *[4 marks]*

Markscheme

(i)



(A1)(A1)(A1)

Notes: Award ***(A1)*** for labels and some idea of scale, ***(A1)*****(ft)*****(A1)*****(ft)** for each line.
The axis can be reversed.

(ii)
$(4, 3)$ or
$(3, 4)$ ***(A1)*****(ft)**

Note: Accept
$b = 4$,
$c = 3$

[4 marks]

Examiners report

(i) Few candidates sketched the graphs well. Few used a ruler.

(ii) Many candidates could not be awarded ft from their graph because the answer they gave was not possible.

8e. *[1 mark]*

Examiners report

Very few correct drawings.

8f. *[2 marks]*

Markscheme

$\tan 70 = \frac{h}{5}$ ***(M1)***

$h = 5\tan 70 = 13.74$ ***(A1)***

$h = 13.7$ cm ***(AG)***

[2 marks]

Examiners report

Some managed to show this more by good fortune and ignoring their original triangle than by good reasoning.

8g. *[4 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in this part of the question where indicated in the left hand column.*

(i)

$\text{EG}^2 = 5^2 + 13.7^2$ OR

$5^2 + (5\tan 70)^2$ ***(M1)***

(UP)

$\text{EG} = 14.6$ cm ***(A1)(G2)***

(ii)

$\text{DEC} = 2 \times \tan^{-1}\left(\frac{5}{14.6}\right)$ ***(M1)***

$= 37.8°$ ***(A1)*****(ft)*****(G2)***

[4 marks]

Examiners report

(i) Many found this as ft from the previous part. Some lost a UP here.

(ii) This was not well done. The most common answer was $40°$.

8h. *[2 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in this part of the question where indicated in the left hand column.*

$\text{Area} = 10 \times 10 + 4 \times 0.5 \times 10 \times 14.619$ ***(M1)***

(UP)

$= 392$ cm^2 ***(A1)*****(ft)*****(G2)***

[2 marks]

Examiners report

Many managed this or were awarded ft points.

8i. *[2 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in this part of the question where indicated in the left hand column.*

Volume $= \frac{1}{3} \times 10 \times 10 \times 13.7$ ***(M1)***

(UP)
$= 457 \text{ cm}^3$ (
458 cm^3) ***(A1)(G2)***

[2 marks]

Examiners report

This was well done and most candidates also remembered their units on this part.

9a. *[2 marks]*

Markscheme

$(3x-2)(x+5)$ ***(A1)(A1)***

[2 marks]

Examiners report

Most candidates made a good attempt to factorise the expression.

9b. *[2 marks]*

Markscheme

$(3x-2)(x+5)=0$

$x = \frac{2}{3}$ or
$x = -5$ ***(A1)*****(ft)*****(A1)*****(ft)*****(G2)***

[2 marks]

Examiners report

Many gained both marks here from a correct answer or ft from the previous part.

9c. *[2 marks]*

Markscheme

$x = \frac{-13}{6}$ (-2.17) ***(A1)(A1)*****(ft)*****(G2)***

Note: ***(A1)*** is for
$x =$, ***(A1)*** for value. **(ft)** if value is half way between roots in (b).

[2 marks]

Examiners report

Many used the formula correctly. Some forgot to put
$x =$.

9d. *[2 marks]*

Markscheme

Minimum

$y = 3\left(\frac{-13}{6}\right)^2 + 13\left(\frac{-13}{6}\right) - 10$ ***(M1)***

Note: ***(M1)*** for substituting their value of x from (c) into $f(x)$.

$= -24.1$ ***(A1)*****(ft)*****(G2)***

[2 marks]

Examiners report

Most candidates found this value from their GDC.

9e. *[2 marks]*

Markscheme

$\text{Area} = 2(2x)x + 2xy + 2(2x)y$ ***(M1)(A1)***

Note: ***(M1)*** for using the correct surface area formula (which can be implied if numbers in the correct place). ***(A1)*** for using correct numbers.

$300 = 4x^2 + 6xy$ ***(AG)***

Note: Final line must be seen or previous ***(A1)*** mark is lost.

[2 marks]

Examiners report

A good attempt was made to show the correct surface area.

9f. *[2 marks]*

Markscheme

$6xy = 300 - 4x^2$ ***(M1)***

$y = \frac{300-4x^2}{6x}$ *or* $\frac{150-2x^2}{3x}$ ***(A1)***

[2 marks]

Examiners report

Many could rearrange the equation correctly.

9g. *[2 marks]*

Markscheme

Volume $= x(2x)y$ ***(M1)***

$V = 2x^2\left(\frac{300-4x^2}{6x}\right)$ ***(A1)*****(ft)**

$= 100x - \frac{4}{3}x^3$ **(AG)**

Note: Final line must be seen or previous ***(A1)*** mark is lost.

[2 marks]

Examiners report

Although this was not a difficult question it probably looked complicated for the candidates and it was often left out.

9h. *[2 marks]*

Markscheme

$\frac{dV}{dx} = 100 - \frac{12x^2}{3}$ or
$100 - 4x^2$ ***(A1)(A1)***

Note: ***(A1)*** for each term.

[2 marks]

Examiners report

Those who reached this length could usually manage the differentiation.

9i. *[5 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable where indicated in the left hand column*

(i) For maximum
$\frac{dV}{dx} = 0$ or
$100 - 4x^2 = 0$ ***(M1)***

$x = 5$ ***(A1)*****(ft)**

$y = \frac{300-4(5)^2}{6(5)}$ or
$\left(\frac{150-2(5)^2}{3(5)}\right)$ ***(M1)***

$= \frac{20}{3}$ ***(A1)*****(ft)**

(UP) (ii)
$333\frac{1}{3}$ cm^3 (333 cm^3)

Note: **(ft)** from their (e)(i) if working for volume is seen.

[5 marks]

Examiners report

(i) Many found the correct value of
x but not of
y.

(ii) This was well done and again the units were included in most scripts.

10a. *[3 marks]*

A
B
C
7.3
60°
90°

90°
90°
$\pm 10^\circ$

$\tan 60$
$\tan 30$

4.21 cm

$= 4.21$ cm

$\frac{7.3}{\sqrt{3}}$

4.21 cm

BC $= 8.43$ cm

Examiners report

The initial diagram was well drawn by most candidates but few could extend
AC to find
D. The point
D was either drawn between
A and
C or on
CA extended. When on
CA extended the candidates could be awarded A1 follow through for the angle. A surprising number of candidates could not find the correct answer for the length of
BC.

10b. *[3 marks]*

Markscheme

(i) For
ACD in a straight line and all joined up to
B, for
20° shown in correct place and
D labelled.
D must be on
AC extended. ***(A1)***

(ii)
$B\hat{C}D = 120°$ ***(A1)***

$C\hat{B}D = 40°$ ***(A1)*** ***(C3)***

[3 marks]

Examiners report

The initial diagram was well drawn by most candidates but few could extend
AC to find
D. The point
D was either drawn between
A and
C or on
CA extended. When on
CA extended the candidates could be awarded A1 follow through for the angle. A surprising number of candidates could not find the correct answer for the length of
BC.

11a. *[1 mark]*

Markscheme

3 ***(A1)*** ***(C1)***

[1 mark]

Examiners report

This question was well answered by some candidates and poorly answered by others. It seemed to be part of the syllabus that might have been fully taught by some schools and not by others. It was surprising to see how many candidates could not find the gradient of a perpendicular line when this has been tested for many years.

11b. *[1 mark]*

Markscheme

$-1/3$ **(ft)** *from (a)* ***(A1)*****(ft)** ***(C1)***

[1 mark]

Examiners report

This question was well answered by some candidates and poorly answered by others. It seemed to be part of the syllabus that might have been fully taught by some schools and not by others. It was surprising to see how many candidates could not find the gradient of a perpendicular line when this has been tested for many years.

11c. *[2 marks]*

Markscheme

Substituting
$(6, 7)$ in
$y =$ their $mx + c$ or equivalent to find
c. ***(M1)***

$y = \frac{-1}{3}x + 9$ or equivalent ***(A1)*****(ft)** ***(C2)***

[2 marks]

Examiners report

This question was well answered by some candidates and poorly answered by others. It seemed to be part of the syllabus that might have been fully taught by some schools and not by others. It was surprising to see how many candidates could not find the gradient of a perpendicular line when this has been tested for many years.

11d. *[2 marks]*

Markscheme

$(1.5, 8.5)$ ***(A1)(A1)*****(ft)** ***(C2)***

Note: Award ***(A1)*** for
1.5, ***(A1)*** for
8.5. **(ft)** from (c), brackets not required.

[2 marks]

Examiners report

This question was well answered by some candidates and poorly answered by others. It seemed to be part of the syllabus that might have been fully taught by some schools and not by others. It was surprising to see how many candidates could not find the gradient of a perpendicular line when this has been tested for many years.

12a. *[2 marks]*

Markscheme

$\frac{1}{2}20^2 \sin B = 100$ ***(M1)(A1)***

$B = 30°$ ***(AG)***

Note: ***(M1)*** for correct substituted formula and ***(A1)*** for correct substitution.
$B = 30°$ must be seen or previous ***(A1)*** mark is lost.

[2 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

Part (a) was not very well answered. It looked as if the candidates did not understand the question. Many candidates did not draw a sketch of the triangle; this would have helped them to solve the question. Many candidates simply calculated the remaining angles of the triangle and showed that the sum was
180° . This was a clear example of the misunderstanding of the term "show that". Part (b) was well done though some candidates lost a mark for not giving the answer to the correct accuracy.

12b. *[3 marks]*

Markscheme

*Unit penalty **(UP)** is applicable where indicated in the left hand column.*

$\overline{\mathrm{AC}}^2 = 2 \times 20^2 - 2 \times 20^2 \times \cos 30^\circ$ ***(M1)(A1)***

(UP)
$\overline{\mathrm{AC}} = 10.4 \text{ cm}$ ***(A1)(G2)***

Note: ***(M1)*** for using cosine rule, ***(A1)*** for correct substitution. Last ***(A1)*** is for the correct answer. Accept use of sine rule or any correct method e.g.
$\mathrm{AC} = 2 \times 20 \sin 15^\circ$.

[3 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

Part (a) was not very well answered. It looked as if the candidates did not understand the question. Many candidates did not draw a sketch of the triangle; this would have helped them to solve the question. Many candidates simply calculated the remaining angles of the triangle and showed that the sum was
180° . This was a clear example of the misunderstanding of the term "show that". Part (b) was well done though some candidates lost a mark for not giving the answer to the correct accuracy.

12c. *[2 marks]*

Markscheme

$x^2 + 6^2 = 10^2$ ***(A1)(M1)***

$x = 8 \text{ cm}$ ***(AG)***

Note: ***(A1)*** for
6 (or
36) seen and ***(M1)*** for using Pythagoras with correct substitution.
$x = 8$ must be seen or previous ***(M1)*** mark is lost.

[2 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

The weaker candidates spent a lot of time in (a) using the wrong triangle to find half of the diagonal of the base. Finally they used Pythagoras theorem with the wrong numbers. Part (b) was well answered by most of the students. For the volume of the pyramid in (c) they used the correct formula though not always with the correct substitutions. To find the height of the prism in (d) the most common error was multiplying the volume of the prism by
$\frac{1}{3}$. It seemed that many did not know the term 'prism'.

12d. *[3 marks]*

Markscheme

$\cos\beta = \frac{6}{10}$ ***(M1)(A1)***

$\beta = 53.1°$ ***(A1)(G2)***

OR equivalent

Note: ***(M1)*** for use of trigonometric ratio with numbers from question. ***(A1)*** for use of correct numbers, and ***(A1)*** for correct answer.

[3 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

The weaker candidates spent a lot of time in (a) using the wrong triangle to find half of the diagonal of the base. Finally they used Pythagoras theorem with the wrong numbers. Part (b) was well answered by most of the students. For the volume of the pyramid in (c) they used the correct formula though not always with the correct substitutions. To find the height of the prism in (d) the most common error was multiplying the volume of the prism by $\frac{1}{3}$. It seemed that many did not know the term 'prism'.

12e. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable where indicated in the left hand column.*

$vol = \frac{12^2 \times 8}{3}$ ***(M1)***

(UP)
$= 384 \text{ cm}^3$ ***(A1)(G2)***

Note: ***(M1)*** for correct formula and correct substitution, ***(A1)*** for correct answer.

[2 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

The weaker candidates spent a lot of time in (a) using the wrong triangle to find half of the diagonal of the base. Finally they used Pythagoras theorem with the wrong numbers. Part (b) was well answered by most of the students. For the volume of the pyramid in (c) they used the correct formula though not always with the correct substitutions. To find the height of the prism in (d) the most common error was multiplying the volume of the prism by $\frac{1}{3}$. It seemed that many did not know the term 'prism'.

12f. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable where indicated in the left hand column.*

Let h be the height

$10^2 h = 384$ ***(M1)***

(UP)
$= 3.84 \text{ cm}$ ***(A1)*****(ft)*****(G2)***

Note: ***(M1)*** for correct formula and correct substitution, ***(A1)*** for correct answer. **(ft)** from answer to part (c).

[2 marks]

Examiners report

Many students did not write the units in their answers and were penalized with the UP in this question.

The weaker candidates spent a lot of time in (a) using the wrong triangle to find half of the diagonal of the base. Finally they used Pythagoras theorem with the wrong numbers. Part (b) was well answered by most of the students. For the volume of the pyramid in (c) they used the correct formula though not always with the correct substitutions. To find the height of the prism in (d) the most common error was multiplying the volume of the prism by $\frac{1}{3}$. It seemed that many did not know the term 'prism'.

13a. *[2 marks]*

Markscheme

Thursday's sales,

$6b + 9m = 23.40$ ***(A1)***

$2b + 3m = 7.80$ ***(A1)*** ***(C2)***

[2 marks]

Examiners report

a) Nearly all the candidates were able to write the equation but very few simplified it.

13b. *[2 marks]*

Markscheme

$m = 1.40$ *(accept 1.4)* ***(A1)*****(ft)**

$b = 1.80$ *(accept 1.8)* ***(A1)*****(ft)**

Award ***(A1)****(d) for a reasonable attempt to solve by hand and answer incorrect.* ***(C2)***

[2 marks]

Examiners report

b) A majority of candidates were able to find the values of b and m. Some used the right method but made arithmetical errors, many of which were due to them using the method of substitution which involved fractions. GDC use was expected.

13c. *[2 marks]*

Markscheme

(A1)(A1)**(ft)**

(A1) *each for two reasonable straight lines. The intersection point must be approximately correct to earn both marks, otherwise penalise at least one line.*

Note: The follow through mark is for candidate's line from (a). ***(C2)***

[2 marks]

Examiners report

c) A majority of candidates did not attempt this part. For those who did, very few were able to sketch the graph correctly. Common errors were to plot the point (1.4, 1.8) or draw a straight line through that point and the origin.

14a. *[2 marks]*

Markscheme

$s = 6$ ***(A1)***

$t = -2$ ***(A1)*** ***(C2)***

[2 marks]

Examiners report

(a) It was surprising how many errors were made in finding the values for *s* and *t*

14b. *[4 marks]*

Markscheme

gradient of AB $= \frac{-2-8}{-2-6} = \frac{-10}{-8} = \frac{5}{4}$ ***(A1)*****(ft)**

(A1) *for gradient of AM or BM*
$= \frac{5}{4}$

Perpendicular gradient $= -\frac{4}{5}$ ***(A1)*****(ft)**

Equation of perpendicular bisector is

$y = -\frac{4}{5}x + c$

$3 = -\frac{4}{5}(2) + c$ ***(M1)***

$c = 4.6$

$y = -0.8x + 4.6$

or
$5y = -4x + 23$ ***(A1)*****(ft)** ***(C4)***

[4 marks]

Examiners report

(b) The candidates had difficulty in finding the equation of a straight line. They could find the gradient of the line AB and a number could give the gradient of the perpendicular line but most did not substitute the correct midpoint to find the equation of the line.

15a. *[2 marks]*

Markscheme

$150\tan 50$ ***(M1)***

OR

$\frac{150}{\tan 40}$ ***(M1)***

$= 179\ (\text{m})$ (
$178.763\ldots$) ***(A1)*** ***(C2)***

Examiners report

[N/A]

15b. *[4 marks]*

Markscheme

$150\tan 50 - 150\tan 35$ ***(M1)(M1)***

Note: Award ***(M1)*** for
$150\tan 35$, ***(M1)*** for subtraction from their part (a).

$= 73.7\ (\text{m})$ (
$73.7319\ldots$) ***(A1)*(ft)**
$= 74\ (\text{m})$ ***(A1)*(ft)** ***(C4)***

Note: The final ***(A1)*** is awarded for the correct rounding of their answer to (b).
Note: There will always be one answer with a specified degree of accuracy on each paper.

Examiners report

[N/A]

16a. *[4 marks]*

Markscheme

(i) (2, – 2) *parentheses not required.* ***(A1)***

(ii) gradient of PQ
$= \left(\frac{-5-1}{0-4}\right) = \frac{6}{4} = \frac{3}{2}(1.5)$ ***(M1)(A1)***

(M1) *for gradient formula with correct substitution*

Award ***(A1)*** *for*
$y = \frac{3}{2}x - 5$ *with no other working*

(iii) gradient of perpendicular is
$-\frac{2}{3}$ ***(A1)*(ft)** ***(C4)***

[4 marks]

Examiners report

There were some good answers, but many candidates showed a shaky understanding of coordinate geometry and some difficulty in dealing with negative numbers. Evidently a favourite question for some centres that consistently scored high marks here.

a) This was done quite well by most candidates with the main errors being reversal of the x, y values in the formula and using the negative, rather than the negative reciprocal for the perpendicular.

16b. *[2 marks]*

Markscheme

$\left(\frac{k+2}{0-2}\right) = -\frac{2}{3}$,
$k = -\frac{2}{3}$ **or**
$y = -\frac{2}{3}x + c$,
$c = -\frac{2}{3} \therefore k = -\frac{2}{3}$ ***(M1)(A1)*****(ft)**

Allow (
$0, -\frac{2}{3}$*)*

(M1) *is for equating gradients or substituting gradient into*
$y = mx + c$ ***(C2)***

[2 marks]

Examiners report

There were some good answers, but many candidates showed a shaky understanding of coordinate geometry and some difficulty in dealing with negative numbers. Evidently a favourite question for some centres that consistently scored high marks here.

b) Poorly answered though many candidates did gain a mark by substituting the correct value for gradient into
$y = mx + c$.

17a. *[1 mark]*

Markscheme

Unit penalty (UP) is applicable where indicated in the left hand column.

(UP)
$\text{P (rectangle)} = 2x + 2(x + 2) = 4x + 4$ cm ***(A1)*** ***(C1)***

(UP) *Simplification not required*

[1 mark]

Examiners report

a) and b) Two thirds of the candidates found the perimeter of the rectangle and the side of the square correctly, though most of them did not include units (thereby incurring a unit penalty).

17b. *[1 mark]*

Markscheme

Unit penalty (UP) is applicable where indicated in the left hand column.

(UP) Side of square = $(4x + 4)/4 = x + 1$ cm ***(A1)*****(ft)** ***(C1)***

[1 mark]

Examiners report

a) and b) Two thirds of the candidates found the perimeter of the rectangle and the side of the square correctly, though most of them did not include units (thereby incurring a unit penalty).

17c. *[4 marks]*

Markscheme

(i)

$2x^2 + 4x + 1 = 49$ or equivalent ***(M1)***

$(x + 6)(x - 4) = 0$

$x = -6$ and
4 ***(A1)***

*Note: award **(A1)** for the values or for correct factors*

Choose
$x = 4$ ***(A1)*****(ft)**

*Award **(A1)**(ft) for choosing positive value.* ***(C3)***

(ii)

Area of square $= 5 \times 5 = 25$ cm^2 ***(A1)*****(ft)**

Note: Follow through from both (b) and (c)(i). ***(C1)***

[4 marks]

Examiners report

c) Although a majority of candidates produced the quadratic equation many were unable to solve it correctly. This could easily be done using the GDC so it was disappointing.

18a. *[3 marks]*

Markscheme

$\pi \times 3.25^2 \times 39$ ***(M1)(A1)***

(= 1294.1398)

Answer 1294.14 (cm^3)(2dp) ***(A1)*****(ft)*****(G2)***

***(UP)** not applicable in this part due to wording of question. **(M1)** is for substituting appropriate numbers from the problem into the correct formula, even if the units are mixed up. **(A1)** is for correct substitutions or correct answer with more than 2dp in cubic centimetres seen. Award **(G1)** for answer to > 2dp with no working and no attempt to correct to 2dp. Award **(M1)(A0)(A1)(ft)** for $\pi \times 32.5^2 \times 39$ cm^3 (= 129413.9824) = 129413.98*

Use of
$\pi = \frac{22}{7}$ **or** 3.142 *etc is premature rounding and is awarded at most **(M1)(A1)(A0)** or **(M1)(A0)(A1)(ft)** depending on whether the intermediate value is seen or not. For all other incorrect substitutions, award **(M1)(A0)** and only follow through the 2 dp correction if the intermediate answer to more decimal places is seen. Answer given as a multiple of*
*π is awarded at most **(M1)(A1)(A0).** As usual, an **unsubstituted** formula followed by correct answer only receives the G marks.*

[3 marks]

Examiners report

(i) Many candidates incurred the new one-off unit penalty here. Too many ignored the call for two decimal places and some extrapolated that instruction to later parts (which was clearly not intended). There was the predictable confusion of using radius instead of diameter. Another common error was to divide the cylinder volume by that of the ball, to decide how many would fit. Some follow-through was allowed later from this error, however, this led to zero or negligible air volume, which was clearly ridiculous.

Choice and use of the formulae for volumes was often competent but the conversion to cubic metres was very badly done. Almost no correct answers were seen at all.

18b. *[1 mark]*

Markscheme

39/6.5 = 6 ***(A1)***

[1 mark]

Examiners report

(i) Many candidates incurred the new one-off unit penalty here. Too many ignored the call for two decimal places and some extrapolated that instruction to later parts (which was clearly not intended). There was the predictable confusion of using radius instead of diameter. Another common error was to divide the cylinder volume by that of the ball, to decide how many would fit. Some follow-through was allowed later from this error, however, this led to zero or negligible air volume, which was clearly ridiculous.

Choice and use of the formulae for volumes was often competent but the conversion to cubic metres was very badly done. Almost no correct answers were seen at all.

18c. *[4 marks]*

Markscheme

*Unit penalty **(UP)** is applicable where indicated in the left hand column.*

(UP) (i) Volume of one ball is
$\frac{4}{3}\pi \times 3.25^3$ cm^3 ***(M1)***

Volume of air $= \pi \times 3.25^2 \times 39 - 6 \times \frac{4}{3}\pi \times 3.25^3 = 431$ cm^3 ***(M1)(A1)*****(ft)*****(G2)***

*Award first **(M1)** for substituted volume of sphere formula or for numerical value of sphere volume seen (143.79… or 45.77… $\times\pi$). Award second **(M1)** for subtracting candidate's sphere volume multiplied by their answer to (b). Follow through from parts (a) and (b) only, but negative or zero answer is always awarded **(A0)**(ft)*

(UP) (ii) 0.000431m^3 or 4.31×10^{-4} m^3 ***(A1)*****(ft)**

[4 marks]

Examiners report

(i) Many candidates incurred the new one-off unit penalty here. Too many ignored the call for two decimal places and some extrapolated that instruction to later parts (which was clearly not intended). There was the predictable confusion of using radius instead of diameter. Another common error was to divide the cylinder volume by that of the ball, to decide how many would fit. Some follow-through was allowed later from this error, however, this led to zero or negligible air volume, which was clearly ridiculous.

Choice and use of the formulae for volumes was often competent but the conversion to cubic metres was very badly done. Almost no correct answers were seen at all.

18d. *[5 marks]*

Markscheme

*Unit penalty **(UP)** is applicable where indicated in the left hand column.*

(i)

Angle $\widehat{BTL} = 180 - 80 - 26.5$ or

$180 - 90 - 26.5 - 10$ ***(M1)***

$= 73.5°$ ***(A1)(G2)***

(ii)

$\frac{BT}{\sin(26.5°)} = \frac{120}{\sin(73.5°)}$ ***(M1)(A1)*****(ft)**

(UP) BT = 55.8 m (3sf) ***(A1)*****(ft)**

[5 marks]

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)(ft)**.*

The answers are (all 3sf)

*(ii)(a) – 124 m **(A0)*****(ft)***

*(ii)(b) 123 m **(A0)***

*(ii)(c) 313 m **(A0)***

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)*****(ft)***

Examiners report

(ii) Candidates were often sloppy in reading the information. In particular, despite the statement BL = 120 clearly written, many took GL as 120. Triangle TBL was often taken as right-angled. Angle BTL presented few problems, though sometimes the method was very long-winded. Candidates often managed part (a) then went awry in later parts. Many unit penalties were applied, if not already used in questions 1 or 2.

18e. *[2 marks]*

Markscheme

*Unit penalty **(UP)** is applicable where indicated in the left hand column.*

TG = 55.8sin(80°) or 55.8cos(10°) ***(M1)***

(UP) = 55.0 m (3sf) ***(A1)*****(ft)*****(G2)***

*Apply **(AP)** if 0 missing*

[2 marks]

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)(ft)**.*

The answers are (all 3sf)

*(ii)(a) – 124 m **(A0)*****(ft)***

*(ii)(b) 123 m **(A0)***

*(ii)(c) 313 m **(A0)***

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)*****(ft)***

Examiners report

(ii) Candidates were often sloppy in reading the information. In particular, despite the statement BL = 120 clearly written, many took GL as 120. Triangle TBL was often taken as right-angled. Angle BTL presented few problems, though sometimes the method was very long-winded. Candidates often managed part (a) then went awry in later parts. Many unit penalties were applied, if not already used in questions 1 or 2.

18f. *[3 marks]*

Markscheme

*Unit penalty **(UP)** is applicable where indicated in the left hand column.*

$MT^2 = 200^2 + 55.8^2 - 2 \times 200 \times 55.8 \times \cos(100^\circ)$ ***(M1)(A1)*****(ft)**

(UP) MT = 217 m (3sf) ***(A1)*****(ft)**

Follow through only from part (ii)(a)(ii). Award marks at discretion for any valid alternative method.

[3 marks]

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)(ft)**.*

The answers are (all 3sf)

*(ii)(a) – 124 m **(A0)*****(ft)**

*(ii)(b) 123 m **(A0)***

*(ii)(c) 313 m **(A0)***

*If radian mode has been used throughout the question, award **(A0)** to the first incorrect answer then follow through, but negative lengths are always awarded **(A0)*****(ft)***

Examiners report

(ii) Candidates were often sloppy in reading the information. In particular, despite the statement BL = 120 clearly written, many took GL as 120. Triangle TBL was often taken as right-angled. Angle BTL presented few problems, though sometimes the method was very long-winded. Candidates often managed part (a) then went awry in later parts. Many unit penalties were applied, if not already used in questions 1 or 2.

19a. *[3 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in question part (a) **only**.*

$AC^2 = 625^2 + 986^2 - 2 \times 625 \times 986 \times \cos 102^\circ$ ***(M1)(A1)***

(= 1619072.159)

AC = 1272.43

(UP) =1270 m ***(A1)*** ***(C3)***

[3 marks]

Examiners report

The candidates who used the cosine and sine rules for this question were successful on the whole. Some had their calculators in radian mode (and hence the second answer for the angle was unrealistic) but this was less frequent than in previous sessions. Those candidates who used right-angled trigonometry scored no marks. Many candidates lost an accuracy penalty in this question.

19b. *[3 marks]*

Markscheme

$\frac{986}{\sin A} = \frac{1270}{\sin 102^\circ}$ ***(M1)(A1)*****(ft)**

$A = 49.4^\circ$ ***(A1)*****(ft)**

OR

$\frac{986}{\sin A} = \frac{1272.43}{\sin 102^\circ}$ ***(M1)(A1)*****(ft)**

$A = 49.3^\circ$ ***(A1)*****(ft)**

OR

$\cos A = \left(\frac{625^2+1270^2-986^2}{2\times 625\times 1270}\right)$ ***(M1)(A1)*****(ft)**

$A = 49.5^\circ$ ***(A1)*****(ft)** ***(C3)***

[3 marks]

Examiners report

The candidates who used the cosine and sine rules for this question were successful on the whole. Some had their calculators in radian mode (and hence the second answer for the angle was unrealistic) but this was less frequent than in previous sessions. Those candidates who used right-angled trigonometry scored no marks. Many candidates lost an accuracy penalty in this question.

20a. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable in question parts (a), (b) and (e)* ***only****.*

$V = \frac{1}{3} \times 3.2^2 \times 2.8$ ***(M1)***

(M1) *for substituting in correct formula*

(UP) = 9.56 cm^3 ***(A1)(G2)***

[2 marks]

Examiners report

The volume of the pyramid and the weight were well done. Many candidates lost their unit penalty here. They had trouble showing that the sloping edge was 3.6 cm. The angle BVC was done well but not the total surface area. They knew that they needed four sides and the base, but finding the area of the triangle proved difficult for the less able candidates.

20b. *[2 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable in question parts (a), (b) and (e)* ***only****.*

9.56×9.3 ***(M1)***

(UP) = 88.9 grams ***(A1)*****(ft)*****(G2)***

[2 marks]

Examiners report

The volume of the pyramid and the weight were well done. Many candidates lost their unit penalty here. They had trouble showing that the sloping edge was 3.6 cm. The angle BVC was done well but not the total surface area. They knew that they needed four sides and the base, but finding the area of the triangle proved difficult for the less able candidates.

20c. *[4 marks]*

Markscheme

$\frac{1}{2}$base $= 1.6$ seen ***(M1)***

*award **(M1)** for halving base*

$OC^2 = 1.6^2 + 1.6^2 = 5.12$ ***(A1)***

*award **(A1)** for one correct use of Pythagoras*

$5.12 + 2.8^2 = 12.96 = VC^2$ ***(M1)***

*award **(M1)** for using Pythagoras again to find VC^2*

VC = 3.6 **AG**

*award **(A1)** for* 3.6 *obtained from* 12.96 *only (not* 12.95…*)* ***(A1)***

OR

$AC^2 = 3.2^2 + 3.2^2 = 20.48$ ***(A1)***

*award **(A1)** for one correct use of Pythagoras*

({\text{OC}} = \frac{1}{2} \sqrt{20.48}\) (= 2.26...) ***(M1)***

*award **(M1)** for halving AC*

$2.8^2 + (2.26...)^2 = VC^2 = 12.96$ ***(M1)***

*award **(M1)** for using Pythagoras again to find VC^2*

VC = 3.6 **AG** ***(A1)***

*award **(A1)** for* 3.6 *obtained from* 12.96 *only (not* 12.95…*)*

[4 marks]

Examiners report

The volume of the pyramid and the weight were well done. Many candidates lost their unit penalty here. They had trouble showing that the sloping edge was 3.6 cm. The angle BVC was done well but not the total surface area. They knew that they needed four sides and the base, but finding the area of the triangle proved difficult for the less able candidates.

20d. *[3 marks]*

Markscheme

$3.2^2 = 3.6^2 + 3.6^2 - 2 \times (3.6)(3.6)\cos$
$B\hat{V}C$ ***(M1)(A1)***

$B\hat{V}C$
$= 52.8°$ *(no* **(ft)** *here)* ***(A1)(G2)***

*award **(M1)** for substituting in correct formula, **(A1)** for correct substitution*

OR

sin
$B\hat{V}M$
$= \frac{1.6}{3.6}$ where *M* is the midpoint of BC ***(M1)(A1)***

$B\hat{V}C$
$= 52.8°$ *(no* **(ft)** *here)* ***(A1)***

[3 marks]

Examiners report

The volume of the pyramid and the weight were well done. Many candidates lost their unit penalty here. They had trouble showing that the sloping edge was 3.6 cm. The angle BVC was done well but not the total surface area. They knew that they needed four sides and the base, but finding the area of the triangle proved difficult for the less able candidates.

20e. *[4 marks]*

Markscheme

Unit penalty ***(UP)*** *is applicable in question parts (a), (b) and (e)* ***only***.

$4 \times \frac{1}{2}(3.6)^2 \times \sin(52.8^\circ) + (3.2)^2$ ***(M1)(M1)(M1)***

award ***(M1)*** *for*
$\times 4$, ***(M1)*** *for substitution in relevant triangle area,* (
$\frac{1}{2}(3.2)(2.8)$ *gets* ***(M0)****)*

(M1) *for*
$+(3.2)^2$

(UP) $= 30.9$ cm^2 *(*(**ft**) *from their (d))* ***(A1)*****(ft)*****(G2)***

[4 marks]

Examiners report

The volume of the pyramid and the weight were well done. Many candidates lost their unit penalty here. They had trouble showing that the sloping edge was 3.6 cm. The angle BVC was done well but not the total surface area. They knew that they needed four sides and the base, but finding the area of the triangle proved difficult for the less able candidates.

21a. *[2 marks]*

Markscheme

for attempt at substituted
$\frac{ydistance}{xdistance}$ ***(M1)***

gradient = 2 ***(A1)(G2)***

[2 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21b. *[2 marks]*

Markscheme

$2x - 3$ ***(A1)(A1)***

(A1) *for*
$2x$, ***(A1)*** *for*
-3

[2 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21c. *[3 marks]*

Markscheme

for their
$2x - 3 =$ *their gradient and attempt to solve* ***(M1)***

$x = 2.5$ ***(A1)*****(ft)**

$y = -5.25$ *(***(ft)** *from their x value)* ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21d. *[4 marks]*

Markscheme

for seeing
$\frac{-1}{their(a)}$ ***(M1)***

solving
$2x - 3 = -\frac{1}{2}$ *(or their value)* ***(M1)***

$x = 1.25$ ***(A1)*****(ft)*****(G1)***

$y = -6.1875$ ***(A1)*****(ft)*****(G1)***

[4 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21e. *[3 marks]*

Markscheme

(i)
$2 \times 2 - 3 = 1$ *(***(ft)** *from (b))* ***(A1)*****(ft)*****(G1)***

(ii)
$y = mx + c$ *or equivalent method to find*
$c \Rightarrow -6 = 2 + c$ ***(M1)***

$y = x - 8$ ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21f. *[1 mark]*

Markscheme

$x = 1.5$ ***(A1)***

[1 mark]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

21g. *[3 marks]*

Markscheme

for substituting their answer to part (f) into the equation of the parabola (1.5, −6.25) *accept* $x = 1.5$, $y = -6.25$ ***(M1)(A1)*****(ft)*****(G2)***

gradient is zero *(accept* $\frac{dy}{dx} = 0$*)* ***(A1)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

22a. *[2 marks]*

Markscheme

E$(8, 0)$ ***(A1)(A1)***

Notes: Brackets required but do not penalize again if mark lost in **Q4** (i)(d). If missing award ***(A1)(A0)***.
Accept
$x = 8$,
$y = 0$
Award ***(A1)*** for
$x = 8$

Examiners report

A number of candidates did not attempt this question worth 12 marks but the majority answered this question partially and were able to gain some marks. Parts (a) and (b) were mostly well done. Very few candidates managed to answer part (c) well; this part of the question required good algebra along with a clear understanding of the situation given in the diagram. Many recovered then in (d) when they were asked to write down the quadratic equation. Solving the equation was not always found to be easy. Use of the GDC was expected but many used the formula. The correct solution,
$t = 3$, was chosen in the last part of the question. However, their justification was often false causing them to lose both the reasoning and the answer mark.

22b. *[2 marks]*

Markscheme

$y + \frac{1}{2}t = 4$ ***(M1)(M1)***

Note: ***(M1)*** for the equation of the line seen. ***(M1)*** for substituting
t.

$y = 4 - \frac{1}{2}t$ ***(AG)***

Note: Final line must be seen or previous ***(M1)*** mark is lost.

[2 marks]

Examiners report

A number of candidates did not attempt this question worth 12 marks but the majority answered this question partially and were able to gain some marks. Parts (a) and (b) were mostly well done. Very few candidates managed to answer part (c) well; this part of the question required good algebra along with a clear understanding of the situation given in the diagram. Many recovered then in (d) when they were asked to write down the quadratic equation. Solving the equation was not always found to be easy. Use of the GDC was expected but many used the formula. The correct solution,
$t = 3$, was chosen in the last part of the question. However, their justification was often false causing them to lose both the reasoning and the answer mark.

22c. *[3 marks]*

Markscheme

Area $= \frac{1}{2} \times (4 + 4 - \frac{1}{2}t) \times t$ ***(M1)(A1)***

Note: ***(M1)*** for substituting in correct formula, ***(A1)*** for correct substitution.

$= \frac{1}{2} \times (8 - \frac{1}{2}t) \times t = \frac{1}{2}(8t - \frac{1}{2}t^2)$ ***(A1)***
$= 4t - \frac{1}{4}t^2$ ***(AG)***

Note: Final line must be seen or previous ***(A1)*** mark is lost.

[3 marks]

Examiners report

A number of candidates did not attempt this question worth 12 marks but the majority answered this question partially and were able to gain some marks. Parts (a) and (b) were mostly well done. Very few candidates managed to answer part (c) well; this part of the question required good algebra along with a clear understanding of the situation given in the diagram. Many recovered then in (d) when they were asked to write down the quadratic equation. Solving the equation was not always found to be easy. Use of the GDC was expected but many used the formula. The correct solution,
$t = 3$, was chosen in the last part of the question. However, their justification was often false causing them to lose both the reasoning and the answer mark.

22d. *[1 mark]*

Markscheme

$4t - \frac{1}{4}t^2 = 9.75$ or any equivalent form. ***(A1)***

[1 mark]

Examiners report

A number of candidates did not attempt this question worth 12 marks but the majority answered this question partially and were able to gain some marks. Parts (a) and (b) were mostly well done. Very few candidates managed to answer part (c) well; this part of the question required good algebra along with a clear understanding of the situation given in the diagram. Many recovered then in (d) when they were asked to write down the quadratic equation. Solving the equation was not always found to be easy. Use of the GDC was expected but many used the formula. The correct solution,
$t = 3$, was chosen in the last part of the question. However, their justification was often false causing them to lose both the reasoning and the answer mark.

22e. *[4 marks]*

Markscheme

(i)
$t = 3$ or
$t = 13$ ***(A1)*****(ft)*****(A1)*****(ft)*****(G2)***

Note: Follow through from candidate's equation to part (d). Award ***(A0)(A1)*****(ft)** for
$(3, 0)$ and
$(13, 0)$.

(ii)
t must be a value between
0 and
8 then
$t = 3$

Note: Accept
B is between
O and
E. Do not award ***(R0)(A1)***.

Examiners report

A number of candidates did not attempt this question worth 12 marks but the majority answered this question partially and were able to gain some marks. Parts (a) and (b) were mostly well done. Very few candidates managed to answer part (c) well; this part of the question required good algebra along with a clear understanding of the situation given in the diagram. Many recovered then in (d) when they were asked to write down the quadratic equation. Solving the equation was not always found to be easy. Use of the GDC was expected but many used the formula. The correct solution,
$t = 3$, was chosen in the last part of the question. However, their justification was often false causing them to lose both the reasoning and the answer mark.