FINAL EXAM RVIEW 2012 – 2013 **ANSWER KEY.**

1. Mean = $\frac{(72\times1.79)+(28\times1.62)}{100}$ (M1)(M1)(M1)

= 1.7424 (= 1.74 to 3 sf) (A1) (C4)

[4]

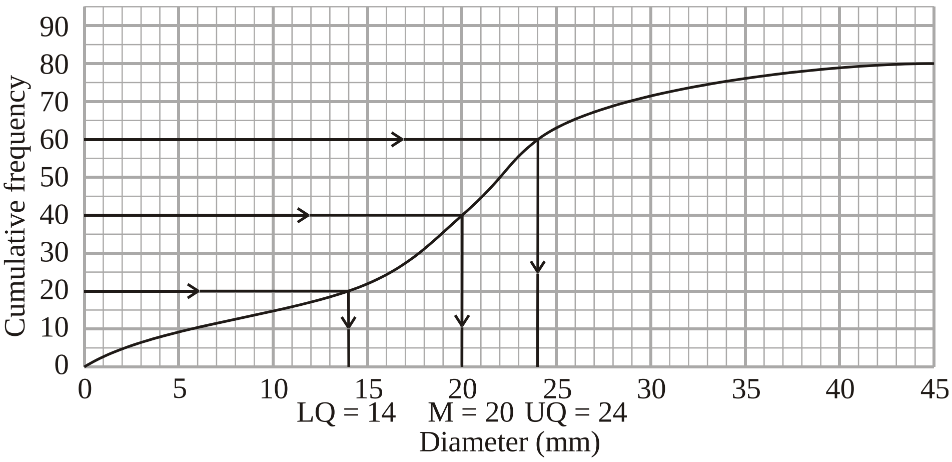
2. $\frac{(10\times1)+(20\times2)+(30\times5)+(40\times k)+(50\times3)}{k+11}$ = 34 (M1)(A1)

$\frac{40k+350}{k+11}$ = 34 (A1)

$\Rightarrow k = 4$ (A1) (C4)

[4]

3.



(a) (i) Correct lines drawn on graph, (A1)(C1)
median = 20 (A1)(C1)

(ii) Correct lines drawn on graph, (A1)(C1)
UQ = Q_3 = 24 (A1)(C1)

(b) IQR = $Q_3 - Q_1$(or UQ – LQ) (M1)
= 10 (accept 14 to 24) (A1) (C2)

Note: *Accept 14 to 24, 24 to 14, 14 – 24 or 24 –14.*

[6]

4. (a) 3 A1 N1

(b) 6 A2 N2

(c) Recognizing the link between 6 and the upper quartile (M1)
eg 25% scored greater than 6,
0.25×32 (A1)
8 A1 N3

[6]

5. (a) (i) $m = 165$ A1 N1

(ii) Lower quartile (1st quarter) = 160 (A1)
Upper quartile (3rd quarter) = 170 (A1)
IQR = 10 A1 N3

(b) Recognize the need to use the 40th percentile, or 48th student (M1)
eg a horizontal line through (0, 48)
$a = 163$ A1 N2

[6]

6. (a) (i) 10 (A1)

(ii) 14 + 10 = 24 (A1) 2

(b)

x_i	f_i
15	1
25	5
35	7
45	9
55	10
65	16
75	14
85	10
95	8
	80 (AG)

(A1) for x_i column; (A1) for f_i column

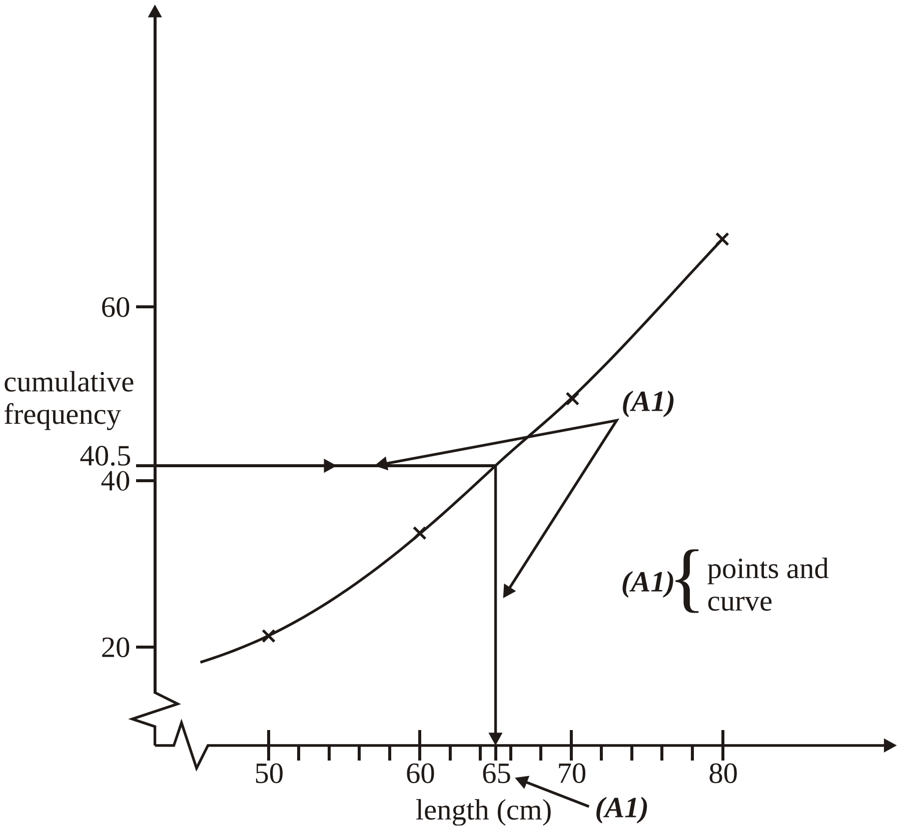
Note: *Award (A0) for using the mid-interval values of 14.5, 24.5 etc.*

(i) $\mu = 63$ (A1)

(ii) $\sigma = 20.5$ (3 sf) (A1) 4

(c) Assymetric diagram/distribution (A1) 1

(d)



3

OR Median = 65 (A3) 3

__Note:__ This answer assumes appropriate use of a calculator with correct arguments.

OR Linear interpolation on the table: (M1)

$\left(\frac{48-40.5}{48-32}\right)\times 60+\left(\frac{40.5-32}{48-32}\right)\times 70 = 65$ (2sf) (A1)(A1) 3

[10]

7. (a)

	Boy	Girl	Total
TV	**13**	**25**	**38**
Sport	33	29	**62**
Total	46	**54**	100

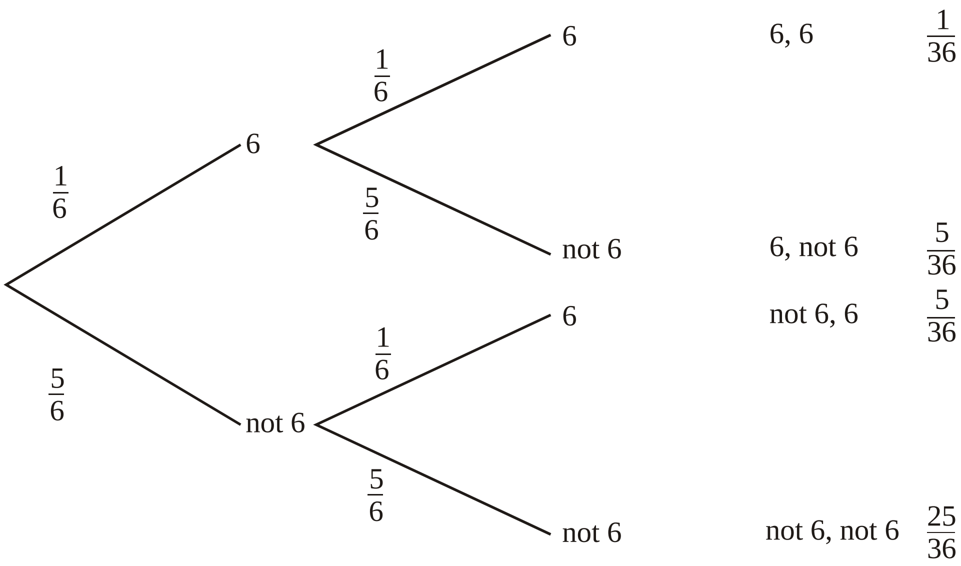
P(TV) = $\frac{38}{100}$ (A1) (C2)

(b) P(TV | Boy) = $\frac{13}{46}$ (= 0.283 to 3 sf) (A2) (C2)

Notes: *Award (A1) for numerator and (A1) for denominator. Accept equivalent answers.*

[4]

8. (a)



(M2) (C2)

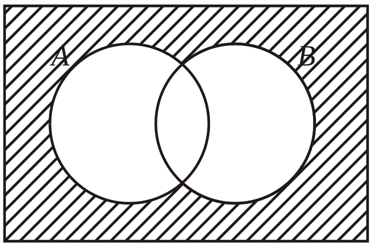
Notes: *Award (M1) for probabilities* $\frac{1}{6}, \frac{5}{6}$ *correctly entered on diagram.*
Award (M1) for correctly listing the outcomes 6, 6; 6 not 6; not 6, 6; not 6, not 6, or the corresponding probabilities.

(b) P(one or more sixes) = $\frac{1}{6}\times\frac{1}{6}+\frac{1}{6}\times\frac{5}{6}+\frac{5}{6}\times\frac{1}{6}$ **or** $\left(1-\frac{5}{6}\times\frac{5}{6}\right)$ (M1)

$= \frac{11}{36}$ (A1) (C2)

[4]

9. (a)



(A1) (C1)

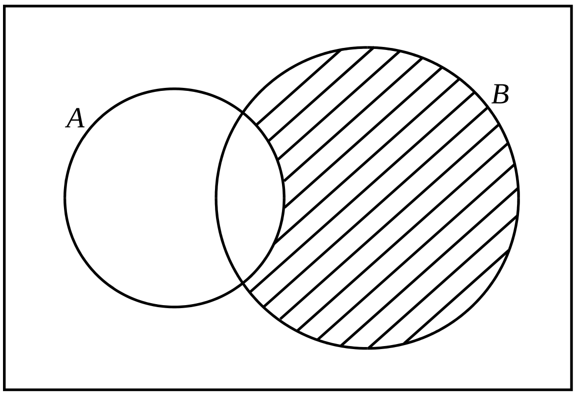
(b) (i) $n(A \cap B) = 2$ (A1) (C1)

(ii) $P(A \cap B) = \frac{2}{36}\left(\text{or } \frac{1}{18}\right)$ (allow **ft** from (b)(i)) (A1) (C1)

(c) $n(A \cap B) \neq 0$ (or equivalent) (R1) (C1)

[4]

10. (a) U



(A1) (C1)

(b) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$65 = 30 + 50 - n(A \cap B)$

$\Rightarrow n(A \cap B) = 15$ (may be on the diagram) (M1)

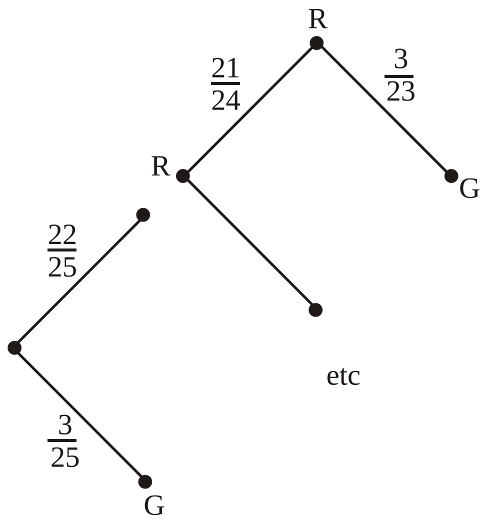
$n(B \cap A') = 50 - 15 = 35$ (A1) (C2)

(c) $P(B \cap A') = \frac{n(B \cap A')}{n(U)} = \frac{35}{100} = 0.35$ (A1) (C1)

[4]

11. (a) $P = \frac{22}{23}$ (= 0.957 (3 sf)) (A2) (C2)

(b)



(M1)

OR

P = P (RRG) + P (RGR) + P (GRR) (M1)

$$\frac{22}{25}\times\frac{21}{24}\times\frac{3}{23}+\frac{22}{25}\times\frac{3}{24}\times\frac{21}{23}+\frac{3}{25}\times\frac{22}{24}\times\frac{21}{23}$$ (M1)(A1)

$$= \frac{693}{2300}$$ (= 0.301 (3 sf)) (A1) (C4)

[6]

13. (a) For taking three ratios of consecutive terms (M1)

$$\frac{54}{18}=\frac{162}{54}=\frac{486}{162}\ (=3)$$ A1

hence geometric AG N0

(b) (i) $r = 3$ (A1)

$u_n = 18 \times 3^{n-1}$ A1 N2

(ii) For a valid attempt to solve $18 \times 3^{n-1} = 1062882$ (M1)

eg trial and error, logs

$n = 11$ A1 N2

[6]

14. Identifying the required term (seen anywhere) M1

eg $\binom{10}{8} \times 2^2$

$\binom{10}{8} = 45$ (A1)

$4y^2$, 2×2, 4 (A2)

$a = 180$ A2 N4

[6]

15. (a) 7 terms A1 N1

(b) A valid approach (M1)

Correct term **chosen** $\binom{6}{3}(x^3)^3(-3x)^3$ A1

Calculating $\binom{6}{3} = 20, (-3)^3 = -27$ (A1)(A1)

Term is $-540x^{12}$ A1 N3

[6]

16. (a) $\log_a 10 = \log_a (5 \times 2)$ (M1)

$= \log_a 5 + \log_a 2$

$= p + q$ A1 N2

(b) $\log_a 8 = \log_a 2^3$ (M1)

$= 3 \log_a 2$

$= 3q$ A1 N2

(c) $\log_a 2.5 = \log_a \frac{5}{2}$ (M1)

$= \log_a 5 - \log_a 2$

$= p - q$ A1 N2

[6]

17. (a) $\frac{1}{5}$ (0.2) A1 N1

(b) (i) $u_{10} = 25\left(\frac{1}{5}\right)^9$ (M1)

$= 0.0000128$ $\left(\left(\frac{1}{5}\right)^7, 1.28 \times 10^{-5}, \frac{1}{78125}\right)$ A1 N2

(ii) $u_n = 25\left(\frac{1}{5}\right)^{n-1}$ A1 N1

(c) For attempting to use infinite sum formula for a GP $\left(\frac{25}{1-\left(\frac{1}{5}\right)}\right)$ (M1)

$S = \frac{125}{4} = 31.25 \ (= 31.3 \text{ to } 3s\ f)$ A1 N2

[6]

18. (a) For taking an appropriate ratio of consecutive terms (M1)

$r = \frac{2}{3}$ A1 N2

(b) For attempting to use the formula for the n^{th} term of a GP (M1)

$u_{15} = 1.39$ A1 N2

(c) For attempting to use infinite sum formula for a GP (M1)

$S = 1215$ A1 N2

[6]

19. (a) (i) $\log_c 15 = \log_c 3 + \log_c 5$ (A1)

$= p + q$ A1 N2

(ii) $\log_c 25 = 2 \log_c 5$ (A1)

$= 2q$ A1 N2

(b) **METHOD 1**

$d^{\frac{1}{2}} = 6$ M1

$d = 36$ A1 N1

METHOD 2

For changing base M1

eg $\dfrac{\log_{10} 6}{\log_{10} d} = \dfrac{1}{2}$, $2\log_{10} 6 = \log_{10} d$

$d = 36$ A1 N1

[6]

20. (a) (i) $r = -2$ A1 N1

(ii) $u_{15} = -3\,(-2)^{14}$ (A1)

$= -49152$ (accept -49200) A1 N2

(b) (i) 2, 6, 18 A1 N1

(ii) $r = 3$ A1 N1

(c) Setting up equation (or a sketch) M1

$\frac{x+1}{x-3}=\frac{2x+8}{x+1}$ (or correct sketch with relevant information) A1

$x^2 + 2x + 1 = 2x^2 + 2x - 24$ (A1)

$x^2 = 25$

$x = 5$ or $x = -5$

$x = -5$ A1 N2

***Notes**: If "trial and error" is used, work must be documented with several trials shown.*
Award full marks for a correct answer with this approach.
*If the work is **not** documented, award N2 for a correct answer.*

(d) (i) $r = \frac{1}{2}$ A1 N1

(ii) For attempting to use infinite sum formula for a GP (M1)

$S = \frac{-8}{1-\frac{1}{2}}$

$S = -16$ A1 N2

***Note:** Award M0A0 if candidates use a value of r where r > 1, or r < –1.*

[12]

21. (a) $p = -\frac{1}{2}$, $q = 2$ (A1)(A1) (C2)

or vice versa

(b) By symmetry C is midway between p, q (M1)

***Note:** This (M1) may be gained by implication.*

$\Rightarrow$ x-coordinate is $\frac{-\frac{1}{2}+2}{2}=\frac{3}{4}$ (A1) (C2)

[4]

22. $(g \circ f)(x) = 0 \quad \Rightarrow \quad 2\cos x + 1 = 0$ (M1)

$\Rightarrow \quad \cos x = -\frac{1}{2}$ (A1)

$x = \frac{2\pi}{3}, \frac{4\pi}{3}$ (A1)(A1) (C4)

Note: *Accept 120°, 240°.*

[4]

23. (a) $f^{-1}(2) \Rightarrow 3x + 5 = 2$ (M1)

$x = -1$ (A1) (C2)

(b) $g(f(-4) = g(-12 + 5)$

$= g(-7)$ (A1)

$= 2(1 + 7)$

$= 16$ (A1) (C2)

[4]

24. $4x^2 + 4kx + 9 = 0$

Only one solution $\Rightarrow b^2 - 4ac = 0$ (M1)

$16k^2 - 4(4)(9) = 0$ (A1)

$k^2 = 9$

$k = \pm 3$ (A1)

But given $k > 0$, $k = 3$ (A1) (C4)

OR

One solution $\Rightarrow (4x^2 + 4kx + 9)$ is a perfect square (M1)

$4x^2 + 4kx + 9 = (2x \pm 3)^2$ by inspection (A2)

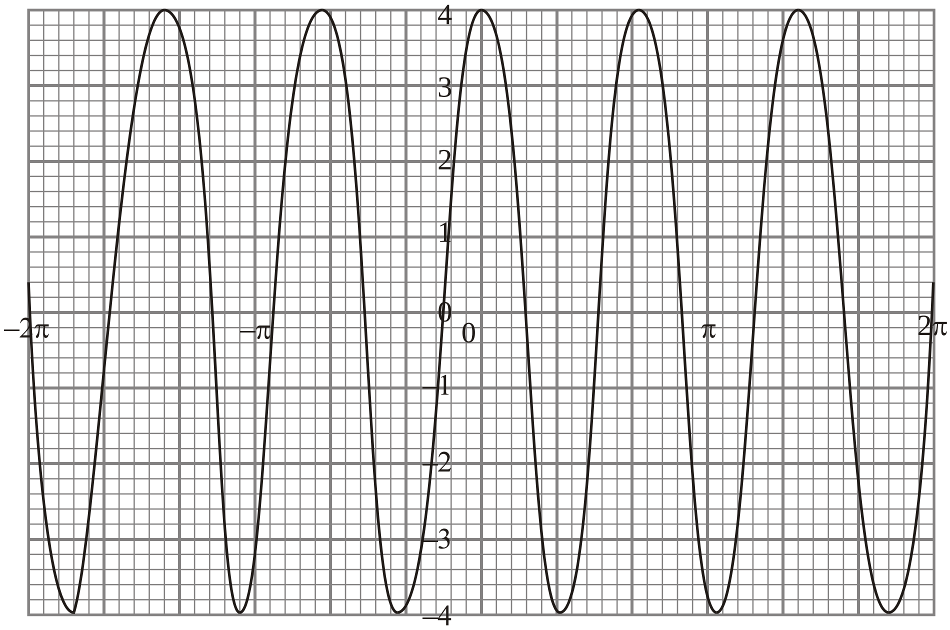
given $k > 0$, $k = 3$ (A1) (C4)

[4]

25. From sketch of graph $y = 4\sin\left(3x + \frac{\pi}{2}\right)$ (M2)

or by observing $|\sin\theta| \le 1$.

$k > 4$, $k < -4$ (A1)(A1)(C2)(C2)



[4]

26. (a) $f(x) = x^2 - 6x + 14$

$f(x) = x^2 - 6x + 9 - 9 + 14$ (M1)

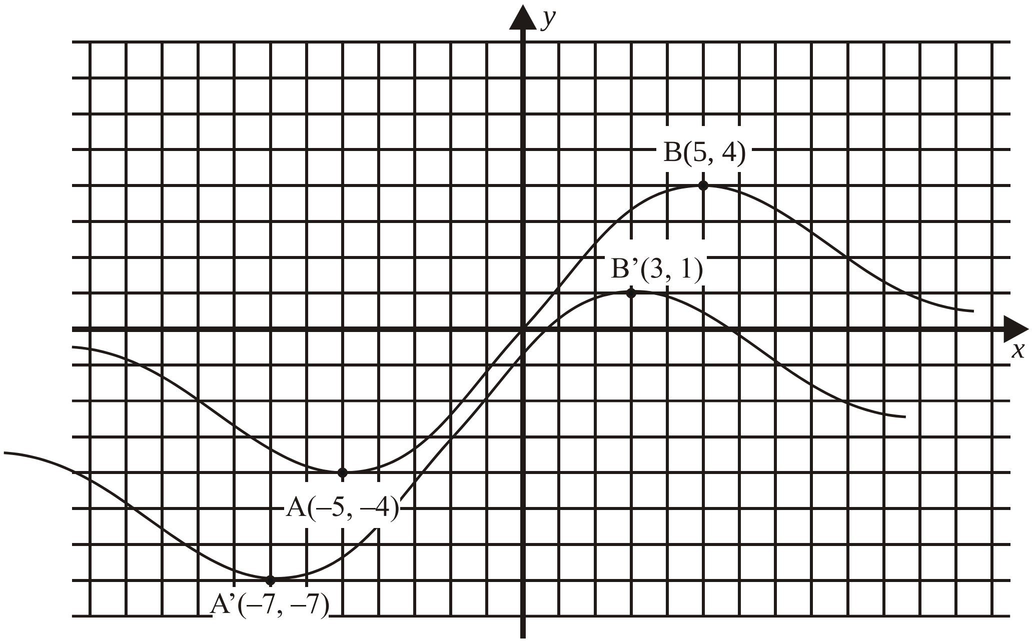
$f(x) = (x - 3)^2 + 5$ (M1)

(b) Vertex is (3, 5) (A1)(A1)

[4]

27. (a) Correct vertical shift (A1)

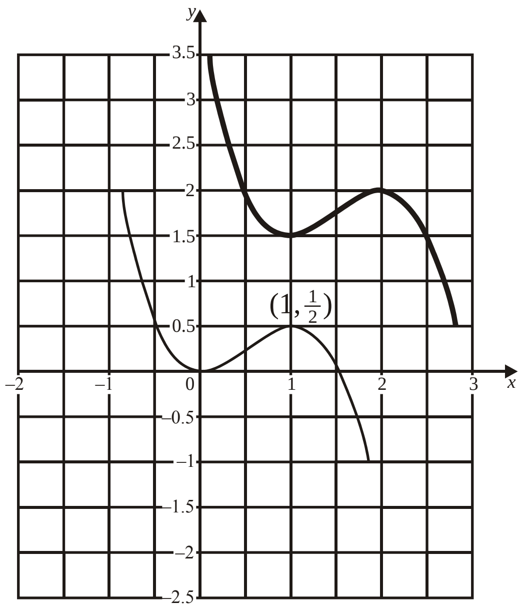
Coordinates of the images (see diagram) (A1) (A1)



(b) Asymptote: $y = -3$ (A1)

[4]

28. (a)



(A2) (C2)

(b) Minimum: $\left(1, \frac{3}{2}\right)$ (A1) (C1)

Maximum: (2, 2) (A1) (C1)

[4]

29. (a) $f(3) = 2^3$ (M1)

$(g \circ f)(3) = \frac{2^3}{2^3 - 2}$ (M1)

$= \frac{8}{6}$ (A1)

$(g \circ f)(3) = \frac{4}{3}$ (C3)

(b) $x = \frac{y}{y-2}$ (M1)

$x(y-2) = y \Rightarrow y(x-1) = 2x$

$\Rightarrow y = \frac{2x}{(x-1)}$ (A1)

$y = \frac{10}{(5-1)} = 2.5$ (A1) (C3)

Note: *Interchanging x and y may take place at any time.*

[6]

30. (a) $2x^2 - 8x + 5 = 2(x^2 - 4x + 4) + 5 - 8$ (M1)

$= 2(x-2)^2 - 3$ (A1)(A1)(A1)

=> $a = 2$, $p = 2$, $q = -3$ (C4)

(b) Minimum value of $2(x-2)^2 = 0$ (or minimum value occurs when $x = 2$) (Ml)

$\Rightarrow$ Minimum value of $f(x) = -3$ (A1) (C2)

OR

Minimum value occurs at (2, –3) (M1)(A1) (C2)

[6]

31. Discriminant $\Delta = b^2 - 4ac$ $(= (-2k)^2 - 4)$ (A1)

$\Delta > 0$ (M2)

Note: *Award (M1)(M0) for* $\Delta \geq 0$.

$(2k)^2 - 4 > 0 \Rightarrow 4k^2 - 4 > 0$

EITHER

$4k^2 > 4$ $(k^2 > 1)$ (A1)

OR

$4(k - 1)(k + 1) > 0$ (A1)

OR

$(2k - 2)(2k + 2) > 0$ (A1)

THEN

$k < -1$ or $k > 1$ (A1)(A1) (C6)

Note: *Award (A1) for* $-1 < k < 1$.

[6]

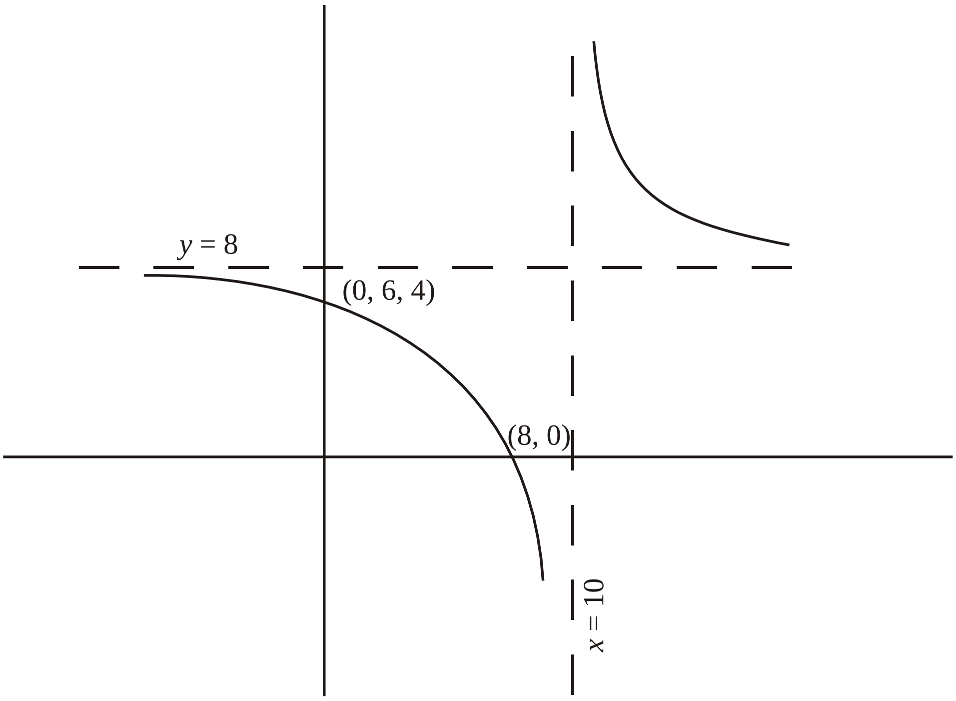
32. (a) (i) $x = 10$ (A1) (N1)

(ii) $y = 8$ (A1) (N1)

(b) (i) 6.4 (or (0, 6.4)) (A1) (N1)

(ii) 8 (or (8, 0)) (A1) (N1)

(c)



(A1)(A1)(A1)(A1) (N4)

Note: *Award (A1) for both asymptotes correctly drawn, (A1) for both intercepts correctly marked, (A1)(A1) for each branch drawn in approximately correct positions. Asymptotes and intercepts need not be labelled.*

(d) There is a vertical translation of 8 units.

(accept translation of $\begin{pmatrix} 0 \\ 8 \end{pmatrix}$) (A2) (N2)

[10]

33. (a) $f(1) = 3$ $f(5) = 3$ (A1)(A1) 2

(b) **EITHER** distance between successive maxima = period (M1)

= 5 – 1 (A1)

= 4 (AG)

OR Period of sin $kx = \frac{2\pi}{k}$; (M1)

so period = $\frac{2\pi}{\frac{\pi}{2}}$ (A1)

= 4 (AG) 2

(c) **EITHER** $A \sin\left(\frac{\pi}{2}\right) + B = 3$ and $A \sin\left(\frac{3\pi}{2}\right) + B = -1$ (M1) (M1)

$\Leftrightarrow A + B = 3, -A + B = -1$ (A1)(A1)

$\Leftrightarrow A = 2, B = 1$ (AG)(A1)

OR Amplitude = A (M1)

$A = \frac{3-(-1)}{2} = \frac{4}{2}$ (M1)

$A = 2$ (AG)

Midpoint value = B (M1)

$B = \frac{3+(-1)}{2} = \frac{2}{2}$ (M1)

$B = 1$ (A1) 5

Note: *As the values of A = 2 and B = 1 are likely to be quite obvious to a bright student, do not insist on too detailed a proof.*

(d) $f(x) = 2\sin\left(\frac{\pi}{2}x\right) + 1$

$f'(x) = \left(\frac{\pi}{2}\right) 2\cos\left(\frac{\pi}{2}x\right) + 0$ (M1)(A2)

Note: *Award (M1) for the chain rule, (A1) for* $\left(\frac{\pi}{2}\right)$, *(A1) for* $2\cos\left(\frac{\pi}{2}x\right)$.

$= \pi\cos\left(\frac{\pi}{2}x\right)$ (A1) 4

Notes: *Since the result is given, make sure that reasoning is valid. In particular, the final (A1) is for simplifying the result of the chain rule calculation. If the preceding steps are not valid, this final mark should not be given. Beware of "fudged" results.*

(e) (i) $y = k - \pi x$ is a tangent $\Rightarrow -\pi = \pi\cos\left(\frac{\pi}{2}x\right)$ (M1)

$\Rightarrow -1 = \cos\left(\frac{\pi}{2}x\right)$ (A1)

$\Rightarrow \frac{\pi}{2}x = \pi$ or 3π or ...

$\Rightarrow x = 2$ or 6 ... (A1)

Since $0 \le x \le 5$, we take $x = 2$, so the point is (2, 1) (A1)

(ii) Tangent line is: $y = -\pi(x - 2) + 1$ (M1)

$y = (2\pi + 1) - \pi x$

$k = 2\pi + 1$ (A1) 6

(f) $f(x) = 2 \Rightarrow 2\sin\left(\frac{\pi}{2}x\right) + 1 = 2$ (A1)

$\Rightarrow \sin\left(\frac{\pi}{2}x\right) = \frac{1}{2}$ (A1)

$\Rightarrow \frac{\pi}{2}x = \frac{\pi}{6} \text{ or } \frac{5\pi}{6} \text{ or } \frac{13\pi}{6}$

$x = \frac{1}{3} \text{ or } \frac{5}{3} \text{ or } \frac{13}{3}$ (A1)(A1)(A1) 5

[24]

34. (a) (i) $Q = \frac{1}{2}(14.6 - 8.2)$ (M1)

$= 3.2$ (A1)

(ii) $P = \frac{1}{2}(14.6 + 8.2)$ (M0)

$= 11.4$ (A1) 3

(b) $10 = 11.4 + 3.2\cos\left(\frac{\pi}{6}t\right)$ (M1)

so $\frac{-7}{16} = \cos\left(\frac{\pi}{6}t\right)$

therefore $\arccos\left(\frac{-7}{16}\right) = \frac{\pi}{6}t$ (A1)

which gives $2.0236... = \frac{\pi}{6}t$ or $t = 3.8648$. $t = 3.86$(3 sf) (A1) 3

(c)	(i)	By symmetry, next time is 12 – 3.86... = 8.135... t = 8.14 (3 sf)	(A1)	
	(ii)	From above, first interval is $3.86 < t < 8.14$	(A1)	
		This will happen again, 12 hours later, so	(M1)	
		$15.9 < t < 20.1$	(A1)	4

[10]

35. (a) using the cosine rule $(A2) = b^2 + c^2 - 2bc\cos\hat{A}$ (M1)

substituting correctly $BC^2 = 65^2 + 104^2 - 2(65)(104)\cos 60°$ A1

$= 4225 + 10816 - 6760 = 8281$

$\Rightarrow$ BC = 91 m A1 3

(b) finding the area, using $\frac{1}{2}bc\sin\hat{A}$ (M1)

substituting correctly, area = $\frac{1}{2}(65)(104)\sin 60°$ A1

$= 1690\sqrt{3}$ (Accept p = 1690) A1 3

(c) (i) $A_1 = \left(\frac{1}{2}\right)(65)(x)\sin 30°$ A1

$= \frac{65x}{4}$ AG 1

(ii) $A_2 = \left(\frac{1}{2}\right)(104)(x)\sin 30°$ M1

$= 26x$ A1 2

(iii) starting $A_1 + A_2 = A$ or substituting $\frac{65x}{4} + 26x = 1690\sqrt{3}$ (M1)

simplifying $\frac{169x}{4} = 1690\sqrt{3}$ A1

$x = \frac{4 \times 1690\sqrt{3}}{169}$ A1

$\Rightarrow x = 40\sqrt{3}$ (Accept q = 40) A1 4

(d) (i) Recognizing that supplementary angles have equal sines

eg $A\hat{D}C = 180 - A\hat{D}B \Rightarrow \sin A\hat{D}C = \sin A\hat{D}B$ R1

(ii) using sin rule in ΔADB and ΔACD (M1)

substituting correctly $\frac{BD}{\sin 30°} = \frac{65}{\sin A\hat{D}B} \Rightarrow \frac{BD}{65} = \frac{\sin 30°}{\sin A\hat{D}B}$ A1

and $\frac{DC}{\sin 30°} = \frac{104}{\sin A\hat{D}B} \Rightarrow \frac{DC}{104} = \frac{\sin 30°}{\sin A\hat{D}C}$ M1

since $\sin A\hat{D}B = \sin A\hat{D}C$

$\frac{BD}{65} = \frac{DC}{104} \Rightarrow \frac{BD}{DC} = \frac{65}{104}$ A1

$\Rightarrow \frac{BD}{DC} = \frac{5}{8}$ AG 5

[18]

36. (a) Evidence of choosing cosine rule (M1)

eg $a^2 = b^2 + c^2 - 2bc \cos A$

Correct substitution A1

eg $(AD)^2 = 7.1^2 + 9.2^2 - 2(7.1)(9.2) \cos 60°$

$(AD)^2 = 69.73$ (A1)

AD = 8.35 (cm) A1 N2

(b) 180° – 162° = 18° (A1)

Evidence of choosing sine rule (M1)

Correct substitution A1

eg $\frac{DE}{\sin 18°} = \frac{8.35}{\sin 110°}$

DE = 2.75 (cm) A1 N2

(c) Setting up equation (M1)

eg $\frac{1}{2} ab \sin C = 5.68$, $\frac{1}{2} bh = 5.68$

Correct substitution A1

eg $5.68 = \frac{1}{2}(3.2)(7.1) \sin D\hat{B}C$, $\frac{1}{2} \times 3.2 \times h = 5.68$, ($h = 3.55$)

$\sin D\hat{B}C = 0.5$ (A1)

$D\hat{B}C$ 30° and/or 150° A1 N2

(d) Finding $A\hat{B}C$ (60° + $D\hat{B}C$) (A1)

Using appropriate formula (M1)

eg $(AC)^2 = (AB)^2 + (BC)^2$, $(AC)^2 = (AB)^2 + (BC)^2 - 2(AB)$

(BC) cos ABC

Correct substitution (allow ***FT*** on **their** seen $A\hat{B}C$)

eg $(AC)^2 = 9.2^2 + 3.2^2$ A1

AC = 9.74 (cm) A1 N3

(e) For finding area of triangle ABD (M1)

Correct substitution Area = $\frac{1}{2} \times 9.2 \times 7.1 \sin 60°$ A1

= 28.28... A1

Area of ABCD = 28.28... + 5.68 (M1)

= 34.0 (cm^2) A1 N3

[21]

37. ***Note:*** *Accept **exact** answers given in terms of π.*

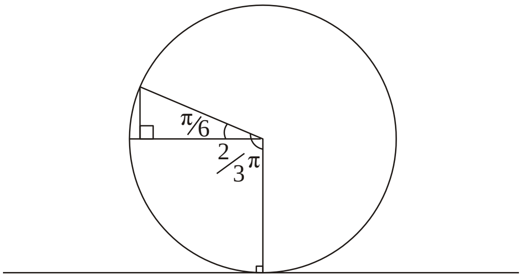
(a) Evidence of using $l = r\theta$ (M1)

arc AB = 7.85 (m) A1 N2

(b) Evidence of using $A = \frac{1}{2} r^2 \theta$ (M1)

Area of sector AOB = 58.9 (m^2) A1 N2

(c) **METHOD 1**



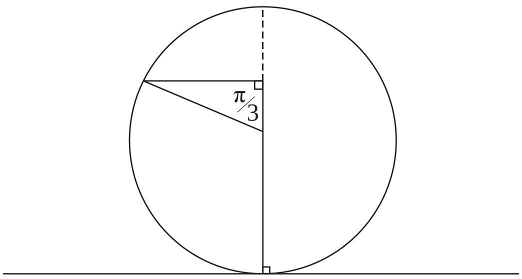
angle = $\frac{\pi}{6}$ $(30°)$ (A1)

attempt to find 15 sin $\frac{\pi}{6}$ M1

height = 15 + 15 sin $\frac{\pi}{6}$

= 22.5 (m) A1 N2

METHOD 2



angle = $\frac{\pi}{3}$ $(60°)$ (A1)

attempt to find 15 cos $\frac{\pi}{3}$ M1

height = 15 + 15 cos $\frac{\pi}{3}$

= 22.5 (m) A1 N2

(d) (i) $h\left(\frac{\pi}{4}\right)=15-15\cos\left(\frac{\pi}{2}+\frac{\pi}{4}\right)$ (M1)

$= 25.6$ (m) A1 N2

(ii) $h(0) = 15 - 15\cos\left(0+\frac{\pi}{4}\right)$ (M1)

$= 4.39$(m) A1 N2

(iii) **METHOD 1**

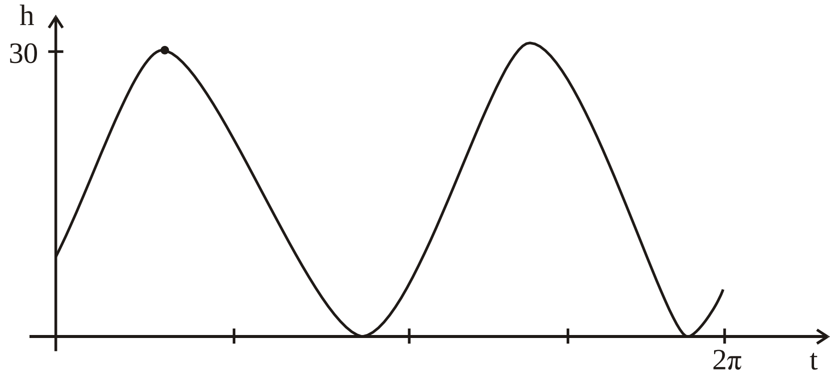
Highest point when $h = 30$ R1

$30 = 15 - 15\cos\left(2t+\frac{\pi}{4}\right)$ M1

$\cos\left(2t+\frac{\pi}{4}\right) = -1$ (A1)

$t = 1.18$ $\left(\text{accept } \frac{3\pi}{8}\right)$ A1 N2

METHOD 2



Sketch of graph of h M2
Correct maximum indicated (A1)
$t = 1.18$ A1 N2

METHOD 3

Evidence of setting $h'(t) = 0$ M1

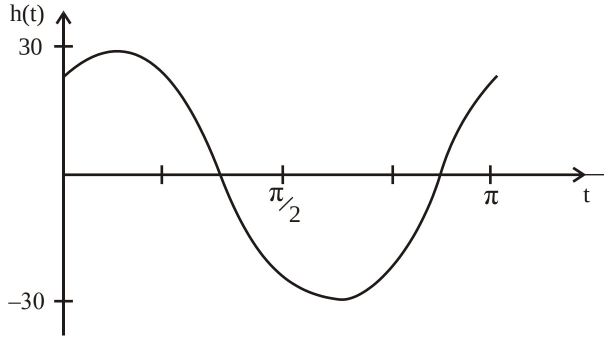
$\sin\left(2t+\frac{\pi}{4}\right)=0$ (A1)

Justification of maximum R1

eg reasoning from diagram, first derivative test, second derivative test

$t = 1.18$ $\left(\text{accept } \frac{3\pi}{8}\right)$ A1 N2

(e) (i)



A1A1A1 N3

Notes: *Award A1 for range –30 to 30, A1 for two zeros.*

Award A1 for approximate correct ***sinusoidal*** *shape.*

[17]

38. (a) (i) 7 A1 N1

(ii) 1 A1 N1

(iii) 10 A1 N1

(b) (i) evidence of appropriate approach M1

eg $A = \frac{18-2}{2}$

$A = 8$ AG N0

(ii) $C = 10$ A2 N2

(iii) **METHOD 1**

period = 12 (A1)

evidence of using B × period = 2π (accept 360°) (M1)

eg $12 = \frac{2\pi}{B}$

$B = \frac{\pi}{6}$ (accept 0.524 or 30) A1 N3

METHOD 2

evidence of substituting (M1)
eg $10 = 8\cos 3B + 10$

simplifying (A1)

eg $\cos 3B = 0$ $\left(3B = \frac{\pi}{2}\right)$

$B = \frac{\pi}{6}$ (accept 0.524 or 30) A1 N3

(c) correct answers A1A1

eg $t = 3.52$, $t = 10.5$, between 03:31 and 10:29 (accept 10:30) N2

[11]