1. $\tan^2 x = \frac{1}{3}$ (M1)

$\Rightarrow \tan x = \pm\frac{1}{\sqrt{3}}$ (M1)

$\Rightarrow x = 30°$ or $x = 150°$ (A1)(A1)(C2)(C2)

[4]

2. $AB = r\theta$

$= \frac{1}{2}r^2\theta \times \frac{2}{r}$ (M1)(A1)

$= 21.6 \times \frac{2}{5.4}$ (A1)

$= 8$ cm (A1)

OR $\frac{1}{2} \times (5.4)^2\theta = 21.6$

$\Rightarrow \theta = \frac{4}{2.7}$ (= 1.481 radians) (M1)

$AB = r\theta$ (A1)

$= 5.4 \times \frac{4}{2.7}$ (M1)

$= 8$ cm (A1) (C4)

[4]

3. ***Note:*** *Award (M1) for identifying the largest angle.*

$\cos\alpha = \frac{4^2 + 5^2 - 7^2}{2 \times 4 \times 5}$ (M1)

$= -\frac{1}{5}$ (A1)

$\Rightarrow \alpha = 101.5°$ (A1)

OR Find other angles first

$\beta = 44.4°$ $\gamma = 34.0°$ (M1)

$\Rightarrow \alpha = 101.6°$ (A1)(A1) (C4)

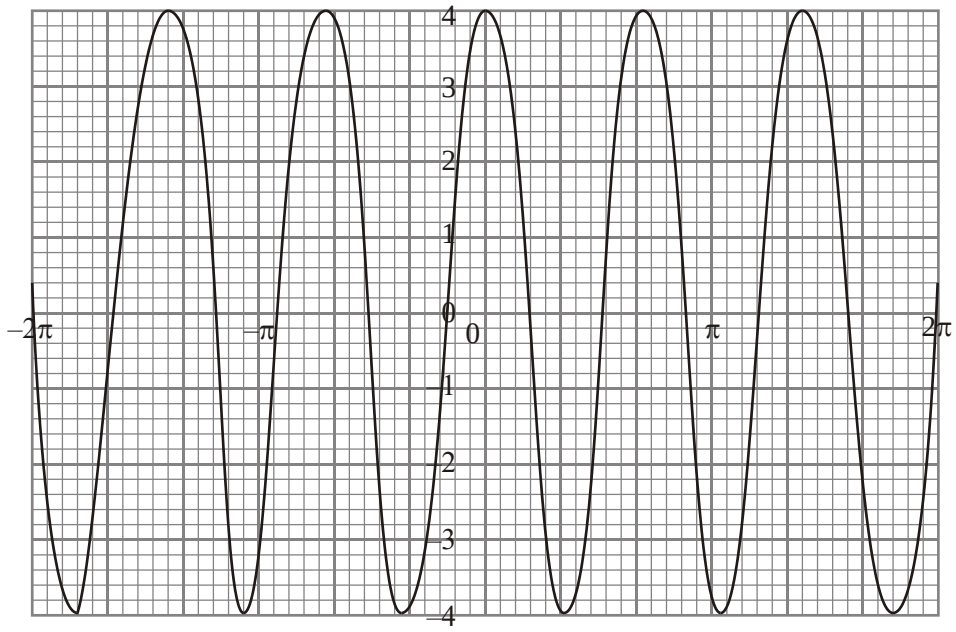
Note: *Award (C3) if not given to the correct accuracy.*

[4]

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

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

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



[4]

5. $\sin A = \frac{5}{13} \Rightarrow \cos A = \pm\frac{12}{13}$ (A1)

But A is obtuse $\Rightarrow \cos A = -\frac{12}{13}$ (A1)

$\sin 2A = 2\sin A\cos A$ (M1)

$= 2 \times \frac{5}{13} \times \left(-\frac{12}{13}\right)$

$= -\frac{120}{169}$ (A1) (C4)

[4]

6. Area of a triangle = $\frac{1}{2} \times 3 \times 4 \sin A$ (A1)

$\frac{1}{2} \times 3 \times 4 \sin A = 4.5$ (A1)

$\sin A = 0.75$ (A1)

$A = 48.6°$ and $A = 131°$ (or 0.848, 2.29 radians) (A1)(A2) (C6)

Note: *Award (C4) for 48.6° only, (C5) for 131° only.*

[6]

7. (a) (i) attempt to substitute (M1)

e.g. $a = \frac{29-15}{2}$

$a = 7$ (accept $a = -7$) A1 N2

(ii) period = 12 (A1)

$b = \frac{2\pi}{12}$ A1

$b = \frac{\pi}{6}$ AG N0

(iii) attempt to substitute (M1)

e.g. $d = \frac{29+15}{2}$

$d = 22$ A1 N2

(iv) $c = 3$ (accept $c = 9$ from $a = -7$) A1 N1

Note: *Other correct values for c can be found,* $c = 3 \pm 12k, k \in \mathbb{Z}$.

(b) stretch takes 3 to 1.5 (A1)

translation maps (1.5, 29) to (4.5, 19) (so M′ is (4.5, 19)) A1 N2

(c) $g(t) = 7 \cos \frac{\pi}{3}(t - 4.5) + 12$ A1A2A1 N4

Note: *Award A1 for* $\frac{\pi}{3}$, ***A2*** *for 4.5, A1 for 12.*

Other correct values for c can be found $c = 4.5 \pm 6k, k \in \mathbb{Z}$.

(d) translation $\begin{pmatrix} -3 \\ 10 \end{pmatrix}$ (A1)

horizontal stretch of a scale factor of 2 (A1)

completely correct description, in correct order A1 N3

e.g. translation $\begin{pmatrix} -3 \\ 10 \end{pmatrix}$ then horizontal stretch of a scale factor of 2

[16]

8. (a) $p = 30$ A2 2

(b) **METHOD 1**

Period = $\frac{2\pi}{q}$ (M2)

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

$\Rightarrow q = 4$ A1 4

METHOD 2

Horizontal stretch of scale factor = $\frac{1}{q}$ (M2)

scale factor = $\frac{1}{4}$ (A1)

$\Rightarrow q = 4$ A1 4

[6]

9. Using sine rule: $\frac{\sin B}{5} = \frac{\sin 48°}{7}$ (M1)(A1)

$\Rightarrow \sin B = \frac{5}{7} \sin 48° = 0.5308\ldots$ (M1)

$\Rightarrow B = \arcsin(0.5308) = 32.06°$ (M1)(A1)

$= 32°$ (nearest degree) (A1) (C6)

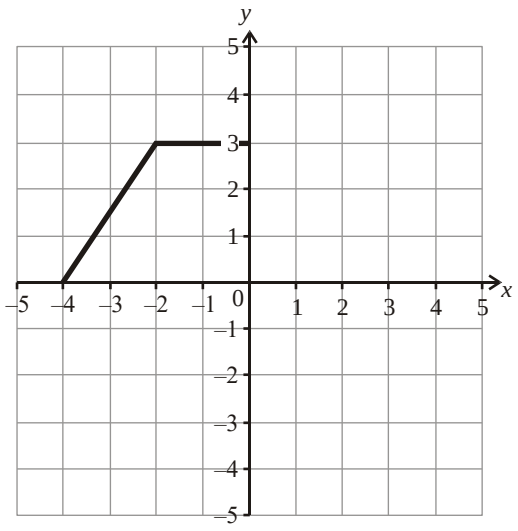
Note: *Award a maximum of [5 marks] if candidates give the answer in radians (0.560).*

[6]

10. (a) (i) 0 A1 N1

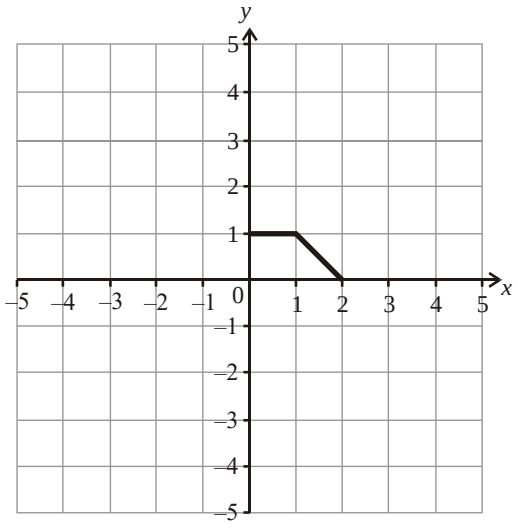
(ii) $-\frac{1}{2}$ A1 N1

(b)



A2 N2

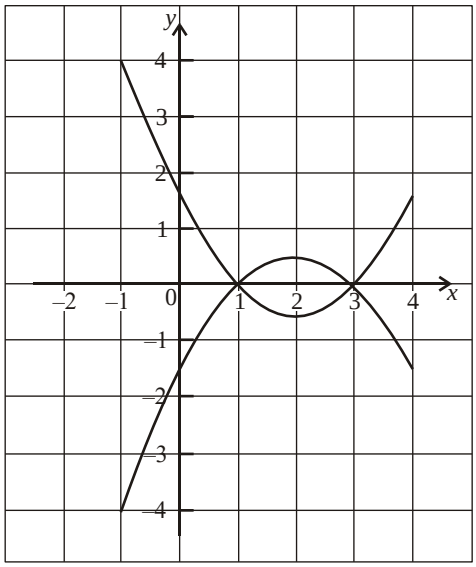
(c)



A2 N2

[6]

11. (a)



M1A1 N2

Note: *Award M1 for evidence of reflection in x-axis, A1 for correct vertex* ***and*** *all intercepts approximately correct.*

(b) (i) $g(-3) = f(0)$ (A1)

$f(0) = -1.5$ A1 N2

(ii) translation (accept shift, slide, *etc*.) of $\begin{pmatrix} -3 \\ 0 \end{pmatrix}$ A1A1 N2

[6]

12. (a) I

(b) III

(c) IV

Note: *Award (C4) for 3 correct, (C2) for 2 correct, (C1) for 1 correct.*

[4]