

C2

1. 1 1.414213562
 1.25 1.341640787
 1.5 1.290994449
 1.75 1.253566341 (5 values correct) B2
 2 1.224744871 (3 or 4 values correct) B1

Correct formula with $h = 0.25$ M1

$$I \approx \frac{0.25}{2} \times \{1.414213562 + 1.224744871 + 2(1.341640787 + 1.290994449 + 1.253566341)\}$$

$$I \approx 10.41136159 \div 8$$

$$I \approx 1.301420198$$

$$I \approx 1.301 \quad (\text{f.t. one slip}) \quad \text{A1}$$

Special case for candidates who put $h = 0.2$

- 1 1.414213562
 1.2 1.354006401
 1.4 1.309307341
 1.6 1.274754878
 1.8 1.247219129
 2 1.224744871 (all values correct) B1

Correct formula with $h = 0.2$ M1

$$I \approx \frac{0.2}{2} \times \{1.414213562 + 1.224744871 + 2(1.354006401 + 1.309307341 + 1.274754878 + 1.247219129)\}$$

$$I \approx 13.00953393 \div 10$$

$$I \approx 1.300953393$$

$$I \approx 1.301 \quad (\text{f.t. one slip}) \quad \text{A1}$$

Note: Answer only with no working earns 0 marks

2. (a) $12(1 - \sin^2 \theta) - 5 \sin \theta = 10$ (correct use of $\cos^2 \theta = 1 - \sin^2 \theta$) M1
 An attempt to collect terms, form and solve quadratic equation
 in $\sin \theta$, either by using the quadratic formula or by getting the
 expression into the form $(a \sin \theta + b)(c \sin \theta + d)$,
 with $a \times c =$ coefficient of $\sin^2 \theta$ and $b \times d =$ constant m1
 $12 \sin^2 \theta + 5 \sin \theta - 2 = 0 \Rightarrow (4 \sin \theta - 1)(3 \sin \theta + 2) = 0$
 $\Rightarrow \sin \theta = \frac{1}{4}, \sin \theta = -\frac{2}{3}$ (c.a.o.) A1
 $\theta = 14.48^\circ, 165.52^\circ$ B1
 $\theta = 221.81^\circ, 318.19^\circ$ B1 B1
 Note: Subtract 1 mark for each additional root in range for each
 branch, ignore roots outside range.
 $\sin \theta = +, -, \text{f.t. for 3 marks, } \sin \theta = -, -, \text{f.t. for 2 marks}$
 $\sin \theta = +, +, \text{f.t. for 1 mark}$

- (b) $2x = -58^\circ, 122^\circ, 302^\circ$ (at least one value) B1
 $x = 61^\circ, 151^\circ$, (both values) B1
 Note: Subtract a maximum of 1 mark for additional roots in range,
 ignore roots outside range.

- (c) $\sin \phi + 2 \sin \phi \cos \phi = 0$ or $\tan \phi + 2 \tan \phi \cos \phi = 0$ M1
 or $\sin \phi \left[\frac{1}{\cos \phi} + 2 \right] = 0$
 $\sin \phi = 0$ (or $\tan \phi = 0$), $\cos \phi = -\frac{1}{2}$ (both values) A1
 $\phi = 0^\circ, 180^\circ$ (both values) A1
 $\phi = 120^\circ$ A1
 Note: Subtract a maximum of 1 mark for each additional root in range
 for each branch, ignore roots outside range.

Special Case:

- No factorisation but division throughout by $\sin \phi$ (or $\tan \phi$) to yield
 $1 + 2 \cos \phi = 0$ (or equivalent) M1
 $\phi = 120^\circ$ A1

3. (a) $\frac{1}{2} \times AC \times 11 \times \sin 110^\circ = 31$
 (substituting the correct values in the
 correct places in the area formula) M1
 $AC = 5.998$ ($AC = 6$) A1
 $BC^2 = 6^2 + 11^2 - 2 \times 6 \times 11 \times \cos 110^\circ$
 (substituting the correct values in the correct places in the cos rule,
 (f.t. candidate's value for AC) M1
 $BC = 14.22$ (f.t. candidate's value for AC) A1

- (b) $\frac{\sin XZY}{2} = \frac{\sin 60^\circ}{2\sqrt{3} - 1}$ (substituting the correct values in the
 correct places in the sine formula) M1
 $\sin XZY = \frac{2 \times \sin 60^\circ}{2\sqrt{3} - 1}$ m1
 $\sin XZY = \frac{6 + \sqrt{3}}{11}$ A1

4. $3 \times \frac{x^{3/2}}{3/2} - 6 \times \frac{x^{-3}}{-3} - x + c$ B1, B1, B1
 (-1 if no constant term present)

5. (a) $S_n = a + [a + d] + \dots + [a + (n - 1)d]$ (at least 3 terms, one at each end) B1
 $S_n = [a + (n - 1)d] + [a + (n - 2)d] + \dots + a$
 Either:
 $2S_n = [a + a + (n - 1)d] + [a + a + (n - 1)d] + \dots + [a + a + (n - 1)d]$
 Or
 $2S_n = [a + a + (n - 1)d] + (n \text{ times})$ M1
 $2S_n = n[2a + (n - 1)d]$
 $S_n = \frac{n[2a + (n - 1)d]}{2}$ (convincing) A1
- (b) $\frac{n[2 \times 4 + (n - 1) \times 2]}{2} = 460$ M1
Either: Rewriting above equation in a form ready to be solved
 $2n^2 + 6n - 920 = 0$ or $n^2 + 3n - 460 = 0$ or $n(n + 3) = 460$
or: $n = 20, n = -23$ A1
 $n = 20$ (c.a.o.) A1
- (c) $a + 4d = 9$ B1
 $(a + 5d) + (a + 9d) = 42$ B1
 An attempt to solve the candidate's two linear equations
 Simultaneously by eliminating one unknown M1
 $d = 4$ (c.a.o.) A1
 $a = -7$ (f.t. candidate's value for d) A1
6. (a) $r = -0.6$ B1
 $S_\infty = \frac{40}{1 - (-0.6)}$ M1
 $S_\infty = 25$ (c.a.o.) A1
- (b) (i) $ar^3 = 8$ B1
 $ar^2 + ar^3 + ar^4 = 28$ B1
 An attempt to solve these equations simultaneously by
 eliminating a M1
 $\frac{r^3}{r^2 + r^3 + r^4} = \frac{8}{28} \Rightarrow 2r^2 - 5r + 2 = 0$ (convincing) A1
- (ii) $r = 0.5$ ($r = 2$ discarded, c.a.o.) B1
 $a = 64$ (f.t. candidate's value for r , provided $|r| < 1$) B1
7. Area = $\int_0^3 \left[3x + \frac{x^3}{5} \right] dx$ (use of integration) M1
 $\frac{3x^2}{2} + \frac{x^4}{4 \times 5}$ (correct integration) B1, B1
 Area = $(27/2 + 81/20) - (3/2 + 1/20)$ (an attempt to substitute limits)
 m1
 Area = 16 (c.a.o.) A1

8. (a) Let $p = \log_a x$
 Then $x = a^p$ (relationship between log and power) B1
 $x^n = a^{pn}$ (the laws of indices) B1
 $\therefore \log_a x^n = pn$ (relationship between log and power)
 $\therefore \log_a x^n = pn = n \log_a x$ (convincing) B1

- (b) **Either:**
 $(2y - 1) \log_{10} 6 = \log_{10} 4$
 (taking logs on both sides and using the power law) M1
 $y = \frac{\log_{10} 4 + \log_{10} 6}{2 \log_{10} 6}$ A1
 $y = 0.887$ (f.t. one slip, see below) A1

- Or:**
 $2y - 1 = \log_6 4$ (rewriting as a log equation) M1
 $y = \frac{\log_6 4 + 1}{2}$ A1
 $y = 0.887$ (f.t. one slip, see below) A1

Note: an answer of $y = -0.113$ from $y = \frac{\log_{10} 4 - \log_{10} 6}{2 \log_{10} 6}$

earns M1 A0 A1

an answer of $y = 1.774$ from $y = \frac{\log_{10} 4 + \log_{10} 6}{\log_{10} 6}$

earns M1 A0 A1

- (c) $\log_a 4 = \frac{1}{2} \Rightarrow 4 = a^{1/2}$ (rewriting log equation as power equation) M1
 $a = 16$ A1

9. (a) $A(4, -1)$ B1
A correct method for finding radius M1
Radius = $\sqrt{10}$ A1
- (b) (i) **Either:**
An attempt to substitute the coordinates of P in the equation of C M1
Verification that $x = 7, y = -2$ satisfy equation of C and hence P lies on C A1
Or:
An attempt to find AP^2 M1
 $AP^2 = 10 \Rightarrow P$ lies on C A1
- (ii) A correct method for finding Q M1
 $Q(1, 0)$ (f.t. candidate's coordinates for A) A1
- (c) An attempt to substitute $(2x - 4)$ for y in the equation of the circle M1
 $x^2 - 4x + 3 = 0$ (or $5x^2 - 20x + 15 = 0$) A1
 $x = 1, x = 3$ (correctly solving candidate's quadratic, both values) A1
Points of intersection are $(1, -2), (3, 2)$ (c.a.o.) A1
10. (a) (i) $L = R\theta - r\theta$ B1
(ii) $K = \frac{1}{2}R^2\theta - \frac{1}{2}r^2\theta$ B1
- (b) An attempt to eliminate θ M1
Use of $R^2 - r^2 = (R + r)(R - r)$ m1
 $r = \frac{2K}{L} - R$ A1
 L