

C2

1.	1	0.5		
	1.25	0.53935989		
	1.5	0.603022689		
	1.75	0.718421208	(5 values correct)	B2
	2	1	(3 or 4 values correct)	B1
	Correct formula with $h = 0.25$			M1
	$I \approx \frac{0.25}{2} \times \{0.5 + 1 + 2(0.53935989 + 0.603022689 + 0.718421208)\}$			
	$I \approx 5.221607574 \div 8$			
	$I \approx 0.652700946$			
	$I \approx 0.6527$			
			(f.t. one slip)	A1

Special case for candidates who put $h = 0.2$

	1	0.5		
	1.2	0.52999894		
	1.4	0.573539334		
	1.6	0.640184399		
	1.8	0.753778361		
	2	1	(all values correct)	B1
	Correct formula with $h = 0.2$			M1
	$I \approx \frac{0.2}{2} \times \{0.5 + 1 + 2(0.52999894 + 0.573539334 + 0.640184399 + 0.753778361)\}$			
	$I \approx 6.495002069 \div 10$			
	$I \approx 0.6495002069$			
	$I \approx 0.6495$			
			(f.t. one slip)	A1

Note: Answer only with no working earns 0 marks

2. (a) $10 \cos^2 \theta + 3 \cos \theta = 4(1 - \cos^2 \theta) - 2$ (correct use of $\sin^2 \theta = 1 - \cos^2 \theta$) M1
 An attempt to collect terms, form and solve quadratic equation in $\cos \theta$, either by using the quadratic formula or by getting the expression into the form $(a \cos \theta + b)(c \cos \theta + d)$, with $a \times c =$ candidate's coefficient of $\cos^2 \theta$ and $b \times d =$ candidate's constant m1
 $14 \cos^2 \theta + 3 \cos \theta - 2 = 0 \Rightarrow (2 \cos \theta + 1)(7 \cos \theta - 2) = 0$
 $\Rightarrow \cos \theta = \frac{2}{7}, \quad \cos \theta = -\frac{1}{2}$ (c.a.o.) A1
 $\theta = 73.40^\circ, 286.60^\circ$ B1
 $\theta = 120^\circ, 240^\circ$ B1 B1
 Note: Subtract 1 mark for each additional root in range for each branch, ignore roots outside range.
 $\cos \theta = +, -, \text{ f.t. for 3 marks, } \cos \theta = -, -, \text{ f.t. for 2 marks}$
 $\cos \theta = +, +, \text{ f.t. for 1 mark}$
- (b) $3x - 21^\circ = -54^\circ, 234^\circ, 306^\circ, 594$ (one value) B1
 $x = 85^\circ, 109^\circ$ B1 B1
 Note: Subtract (from final two marks) 1 mark for each additional root in range, ignore roots outside range.
- (c) Use of $\frac{\sin \phi}{\cos \phi} = \tan \phi$ M1
 $\tan \phi = 0.2$ A1
 $\phi = 11.31^\circ, 191.31^\circ$ (f.t. $\tan \phi = a$) B1
3. (a) $11^2 = 5^2 + x^2 - 2 \times 5 \times x \times \frac{2}{5}$ (correct use of cos rule) M1
 An attempt to collect terms, form and solve quadratic equation in x , either by using the quadratic formula or by getting the expression into the form $(x + b)(x + d)$, with $b \times d =$ candidate's constant m1
 $x^2 - 4x - 96 = 0 \Rightarrow x = 12$ (c.a.o.) A1
- (b) $\frac{\sin XZY}{32} = \frac{\sin 19^\circ}{15}$
 (substituting the correct values in the correct places in the sin rule) M1
 $XZY = 44^\circ, 136^\circ$ (at least one value) A1
 Use of angle sum of a triangle = 180° M1
 $YXZ = 117^\circ, 25^\circ$ (both values)
 (f.t. candidate's values for XZY provided both M's awarded) A1

4. (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:
 $2S_n = [a + a + (n - 1)d] \quad n \text{ times} \quad \text{M1}$
 $2S_n = n[2a + (n - 1)d]$
 $S_n = \frac{n[2a + (n - 1)d]}{2} \quad \text{(convincing)} \quad \text{A1}$
- (b) $a + 2d + a + 3d + a + 9d = 79 \quad \text{B1}$
 $a + 5d + a + 6d = 61 \quad \text{B1}$
 An attempt to solve the candidate's linear equations simultaneously by eliminating one unknown M1
 $a = 3, d = 5$ (both values) (c.a.o.) A1
- (c) $a = 15, d = -2 \quad \text{B1}$
 $S_n = \frac{n[2 \times 15 + (n - 1)(-2)]}{2} \quad \text{(f.t. candidate's } d) \quad \text{M1}$
 $S_n = n(16 - n) \quad \text{(c.a.o.) A1}$
5. (a) $a + ar = 72 \quad \text{B1}$
 $a + ar^2 = 120 \quad \text{B1}$
 An attempt to solve candidate's equations simultaneously by correctly eliminating a M1
 $3r^2 - 5r - 2 = 0 \quad \text{(convincing)} \quad \text{A1}$
- (b) An attempt to solve quadratic equation in r , either by using the quadratic formula or by getting the expression into the form $(ar + b)(cr + d)$, with $a \times c = 3$ and $b \times d = -2$ M1
 $(3r + 1)(r - 2) = 0 \Rightarrow r = -\frac{1}{3} \quad \text{A1}$
 $a \times (1 - \frac{1}{3}) = 72 \Rightarrow a = 108$ (f.t. candidate's derived value for r) B1
 $S_\infty = \frac{108}{1 - (-\frac{1}{3})} \quad \text{(correct use of formula for } S_\infty, \text{ f.t. candidate's derived values for } r \text{ and } a) \quad \text{M1}$
 $S_\infty = 81 \quad \text{(c.a.o.) A1}$

6. (a) $3 \times \frac{x^{3/2}}{3/2} - 2 \times \frac{x^{-2/3}}{-2/3} + c$ B1 B1
 (–1 if no constant term present)
- (b) (i) $36 - x^2 = 5x$ M1
 An attempt to rewrite and solve quadratic equation
 in x , either by using the quadratic formula or by getting the
 expression into the form $(x + a)(x + b)$, with $a \times b = -36$ m1
 $(x - 4)(x + 9) = 0 \Rightarrow A(4, 20)$ (c.a.o.) A1
 $B(6, 0)$ B1
- (ii) Area of triangle = 40 (f.t. candidate's coordinates for A) B1
 Area under curve = $\int_4^6 (36 - x^2) dx$ (use of integration) M1
 $\int 36 dx = 36x$ and $\int x^2 dx = \frac{x^3}{3}$ B1
 Area under curve = $[(216 - 216/3) - (144 - 64/3)]$
 (substitution of candidate's limits) m1
 = $64/3$
 Use of candidate's, x_A, x_B as limits and trying to find total area
 by adding area of triangle and area under curve m1
 Total area = $40 + 64/3 = 184/3$ (c.a.o.) A1

7. (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:**
 $(x/2 - 3) \log_{10} 9 = \log_{10} 6$
 (taking logs on both sides and using the power law) M1
 $x = \frac{2(\log_{10} 6 + 3 \log_{10} 9)}{\log_{10} 9}$ A1
 $x = 7.631$ (f.t. one slip, see below) A1
Or:
 $x/2 - 3 = \log_9 6$ (rewriting as a log equation) M1
 $x = 2(\log_9 6 + 3)$ A1
 $x = 7.631$ (f.t. one slip, see below) A1
 Note: an answer of $x = -4.369$ from $x = \frac{2(\log_{10} 6 - 3 \log_{10} 9)}{\log_{10} 9}$

earns M1 A0 A1

an answer of $x = 3.815$ from $x = \frac{\log_{10} 6 + 3 \log_{10} 9}{\log_{10} 9}$

earns M1 A0 A1

an answer of $x = 1.908$ from $x = \frac{(\log_{10} 6 + 3 \log_{10} 9)}{2 \log_{10} 9}$

earns M1 A0 A1

an answer of $x = 4.631$ from $x = \frac{2 \log_{10} 6 + 3 \log_{10} 9}{\log_{10} 9}$

earns M1 A0 A1

Note: Answer only with no working earns 0 marks

- (c) $\log_a (x - 2) + \log_a (4x + 1) = \log_a [(x - 2)(4x + 1)]$ (addition law) B1
 $2 \log_a (2x - 3) = \log_a (2x - 3)^2$ (power law) B1
 $(x - 2)(4x + 1) = (2x - 3)^2$ (removing logs) M1
 $x = 2.2$ (c.a.o.) A1

Note: Answer only with no working earns 0 marks

8. (a) $A(2, -3)$ B1
 A correct method for finding the radius M1
 Radius = $\sqrt{12}$ A1
- (b) $AT^2 = 61$ (f.t. candidate's coordinates for A) B1
 Use of $RT^2 = AT^2 - AR^2$ M1
 $RT = 7$ (f.t. candidate's radius and coordinates for A) A1

9. Area of sector $POQ = \frac{1}{2} \times r^2 \times 1.12$ B1
- Area of triangle $POQ = \frac{1}{2} \times r^2 \times \sin(1.12)$ B1
- $10.35 = \frac{1}{2} \times r^2 \times 1.12 - \frac{1}{2} \times r^2 \times \sin(1.12)$
- (f.t. candidate's expressions for area of sector and area of triangle) M1
- $r^2 = \frac{2 \times 10.35}{(1.12 - 0.9)}$ (o.e.) (c.a.o.) A1
- $r = 9.7$ (f.t. one numerical slip) A1