

**OCR**

**A Level**

# A Level Maths

OCR Core Maths C2 January  
2012 Model Solutions

Name:



Mathsmadeeasy.co.uk

Total Marks:

Jan 12 OCR C2

i.  $l = r\theta = 4.2 \times 12 = 50.4$

$P = l + 2r = 74.4 \text{ cm}$

ii.  $A = \frac{1}{2}r^2\theta = \frac{1}{2}(12)^2(4.2) = 302.45 \text{ cm}^2$

2.	$y = \log(2x+1)$	$x$	
		$y_0$	4 $\log 9$
		$y_1$	5.5 $\log 12$
		$y_2$	7 $\log 15$
		$y_3$	8.5 $\log 18$
		$y_4$	10 $\log 21$

$h = \frac{10-4}{4} = \frac{3}{2}$

$\frac{1}{2} \cdot \frac{3}{2} \left\{ (\log 9 + \log 21) + 2(\log 12 + \log 15 + \log 18) \right\}$

$= 6.97$  to 3 s.f.

2ii. The tops of the trapezia are below the curve so will be underestimate.

3.  $(4+ax)^6 = 4^6 + C_1^6(4)^5(ax) + C_2^6(4)^4(ax)^2 + C_3^6(4)^3(ax)^3 + \dots$

$\Rightarrow 1280a^3x^3 = 160x^3$

$a^3 = \frac{1}{8} \Rightarrow a = \frac{1}{2}$

3ii.  $(4 + \frac{x}{2})^6 = 4^6 + C_1^6(4)^5(\frac{x}{2})$

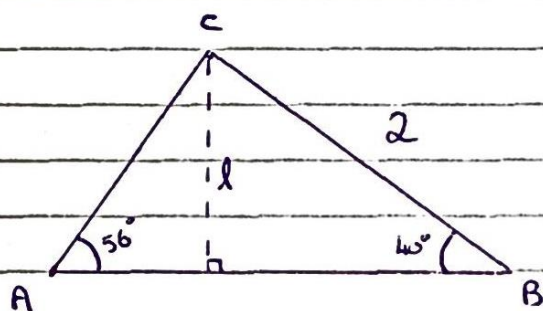
$= 4096 + 3072x$

4i.  $b^2 = 2^2 + 2.4^2 - 2(2)(2.4) \cos 40^\circ$   
 $b = 1.55 \text{ km to } 3\text{s.f.}$

4ii.  $\frac{\sin A}{2} = \frac{\sin 40}{1.55} \Rightarrow A = 56^\circ$

so bearing from A to C is  $124^\circ$

4iii.



$$\frac{l}{\sin 60} = \frac{2}{\sin 90}$$

$\Rightarrow l = 1.29 \text{ km } 3\text{s.f.}$

5i.  $f(x) = 2x^3 + 3x^2 - 17x + 6$   
 $f(3) = 2(3)^3 + 3(3)^2 - 17(3) + 6 = 36$

5ii.

$$\begin{array}{r} 2x^2 + 7x - 3 \\ x-2 \overline{) 2x^3 + 3x^2 - 17x + 6} \\ \underline{2x^3 - 4x^2} \phantom{+ 6} \\ 7x^2 - 17x \phantom{+ 6} \\ \underline{7x^2 - 14x} \phantom{+ 6} \\ -3x + 6 \\ \underline{-3x + 6} \\ 0 \end{array}$$

$f(x) = (x-2)(2x^2 + 7x - 3)$

5iii.  $f(x) = (x-2)(2x^2 + 7x - 3)$

one root

$7^2 - 4(2)(-3) = 73$

$73 > 0 \Rightarrow$  two d.r.c.

so  $f(x)$  has 3 d.r.c.

$$6i. \quad u_n = 85 - 5n$$

$$u_1 = 85 - 5(1) = 80$$

$$u_2 = 85 - 5(2) = 75$$

$$u_3 = 85 - 5(3) = 70$$

$$6ii. \quad \sum_{n=1}^{20} u_n = \frac{1}{2} n (2a + (n-1)d)$$

$$= \frac{1}{2} (20) (2(80) + (19)(-5))$$

$$= 650$$

$$6iii. \quad u_1 = 80, \quad u_5 = 60$$

$$r = \frac{60}{80} = \frac{3}{4}$$

$$u_p = 85 - 5p = 45$$

$$p = 8$$

$$6iv. \quad S_{\infty} = \frac{a}{1-r}$$

$$= \frac{80}{1-\frac{3}{4}}$$

$$= 320$$

$$7a. \int (x^2+4)(x-6) dx = \int x^3 - 6x^2 + 4x - 24 dx$$

$$= \frac{1}{4}x^4 - 2x^3 + 2x^2 - 24x + c$$

$$7b. I_1 = \int_0^1 6x^{3/2} dx = \left[ \frac{12}{5} x^{5/2} \right]_0^1 = \frac{12}{5}$$

$$y = 8x^{-2} - 2, \quad x = 2 \quad \text{when} \quad y = 0$$

$$I_2 = \int_1^2 8x^{-2} - 2 dx = \left[ -8x^{-1} - 2x \right]_1^2 = (-8 - 4)$$

$$\text{so shaded area} = \frac{12}{5} + 2 = \frac{22}{5}$$

$$8a. \quad 7^{w-3} = 184$$

$$(w-3) \ln 7 = \ln 184$$

$$w = 3 + \frac{\ln 184}{\ln 7}$$

$$= 5.68 \text{ to } 3 \text{ s.f.}$$

$$8b. \quad \textcircled{1} \quad \log x + \log y = \log 3$$

$$\log xy = \log 3 \quad \Rightarrow \quad xy = 3$$

$$\textcircled{2} \quad \log(3x+y) = 1$$

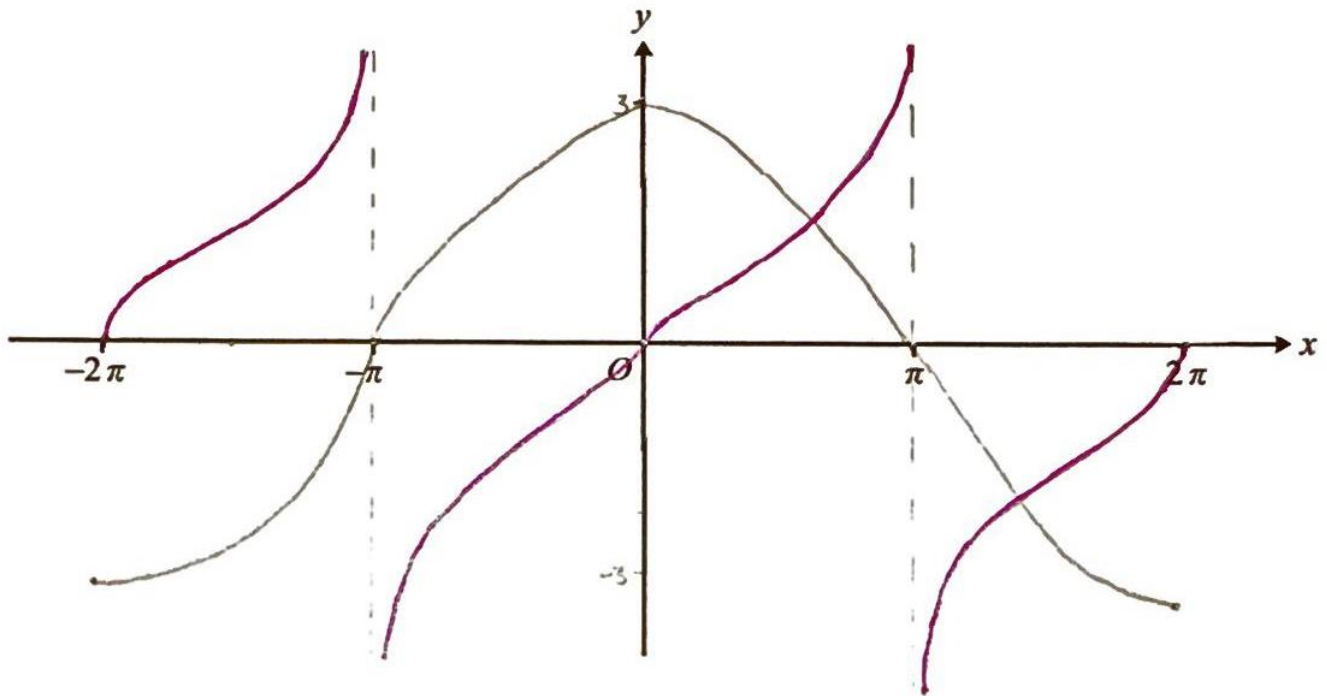
$$3x+y = 10 \quad \Rightarrow \quad y = 10 - 3x$$

$$\text{sub } \textcircled{2} \text{ in } \textcircled{1} \quad x(10-3x) = 3$$

$$10x - 3x^2 - 3 = 0 \quad (3x-1)(x-3) = 0$$

$$x = 3 \quad \Rightarrow \quad y = 1$$

$$\text{or } x = \frac{1}{3} \quad \Rightarrow \quad y = 9$$



$$\tan\left(\frac{1}{2}x\right) = 3 \cos\left(\frac{1}{2}x\right)$$

$$\frac{\sin\left(\frac{1}{2}x\right)}{\cos\left(\frac{1}{2}x\right)} = 3 \cos\left(\frac{1}{2}x\right)$$

$$\sin\left(\frac{1}{2}x\right) = 3 \cos^2\left(\frac{1}{2}x\right) \quad \cos^2\theta = 1 - \sin^2\theta$$

$$\sin\left(\frac{1}{2}x\right) = 3(1 - \sin^2\left(\frac{1}{2}x\right))$$

$$\sin\left(\frac{1}{2}x\right) = 3 - 3 \sin^2\left(\frac{1}{2}x\right)$$

$$3 \sin^2\left(\frac{1}{2}x\right) + \sin x - 3 = 0$$

$$3 \sin^2\left(\frac{1}{2}x\right) + \sin\left(\frac{1}{2}x\right) - 3 = 0$$

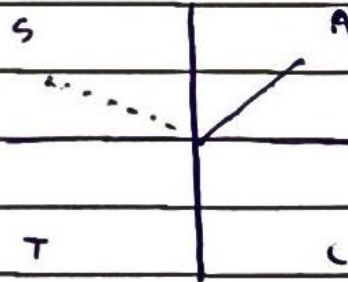
$$-2\pi \leq x \leq 2\pi$$

$$-\pi \leq \frac{1}{2}x \leq \pi$$

$$\begin{aligned}\sin\left(\frac{1}{2}x\right) &= \frac{-1 \pm \sqrt{1^2 - 4(3)(-3)}}{6} \\ &= \frac{-1 \pm \sqrt{37}}{6}\end{aligned}$$

if  $\sin\left(\frac{1}{2}x\right) \neq \frac{-1 - \sqrt{37}}{6}$  impossible

$$\sin\left(\frac{1}{2}x\right) = \frac{1 + \sqrt{37}}{6} \Rightarrow \frac{1}{2}x = 1.010555$$



$$\frac{1}{2}x = 1.0106, 2.1310$$

$$x = 2.02, 4.26$$