Solomon Practice Paper

Core Mathematics 2H

Time allowed: 90 **minutes**

Question	Points	Score
1	4	
2	5	
3	8	
4	9	
5	9	
6	9	
7	9	
8	10	
9	12	
Total:	75	

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Name:

Teacher:

How I can achieve better:

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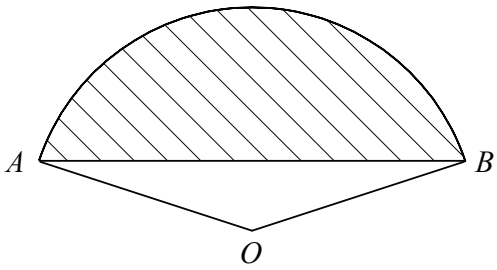
1. A circle has the equation $x^2 + y^2 - 6y - 7 = 0$.

   (a) Find the coordinates of the centre of the circle. [2]

   (b) Find the radius of the circle. [2]

Total: 4

2. Figure shows the sector OAB of a circle, centre O, in which $\angle AOB = 2.5$ radians.



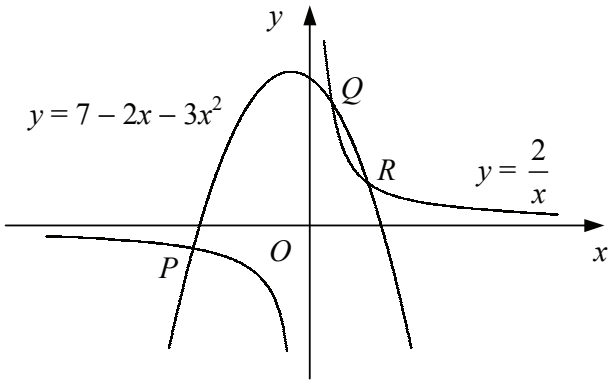
Given that the perimeter of the sector is 36 cm,

(a) find the length OA, [2]

(b) find the area of the shaded segment. [3]

Total: 5

3. Figure shows the curves with equations $y = 7 - 2x - 3x^2$ and $y = \frac{2}{x}$.



The two curves intersect at the points P, Q and R.

(a) Show that the x-coordinates of P, Q and R satisfy the equation $3x^3 + 2x^2 - 7x + 2 = 0$. [2]

Given that P has coordinates $(-2, -1)$,

(b) find the coordinates of Q and R. [6]

Total: 8

4. (a) Expand $(1+x)^4$ in ascending powers of x. [2]

   (b) Using your expansion, express each of the following in the form $a+b\sqrt{2}$, where a and b are integers. [7]

   i. $\left(1+\sqrt{2}\right)^4$

   ii. $\left(1-\sqrt{2}\right)^8$

Total: 9

5. (a) Describe fully a single transformation that maps the graph of $y = 3^x$ onto the graph of $y = \left(\frac{1}{3}\right)^x$. [1]

   (b) Sketch on the same diagram the curves $y = \left(\frac{1}{3}\right)^x$ and $y = 2(3^x)$, showing the coordinates of any points where each curve crosses the coordinate axes. [3]

   The curves $y = \left(\frac{1}{3}\right)^x$ and $y = 2(3^x)$ intersect at the point P.

   (c) Find the x-coordinate of P to 2 decimal places and show that the y-coordinate of P is $\sqrt{2}$. [5]

Total: 9

6. A curve has the equation

$$y = x^3 + ax^2 - 15x + b,$$

where a and b are constants.

Given that the curve is stationary at the point $(-1, 12)$,

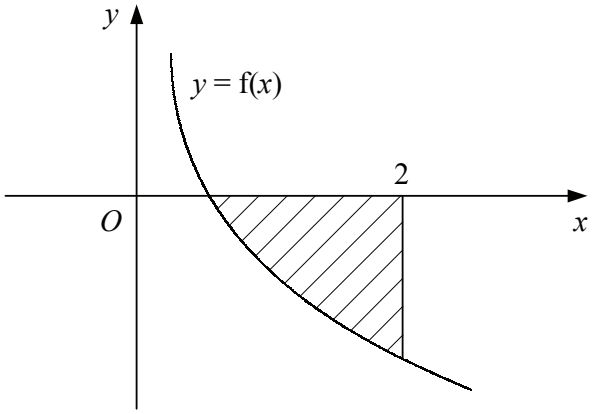
(a) find the values of a and b, [6]

(b) find the coordinates of the other stationary point of the curve. [3]

Total: 9

7. Figure shows part of the curve $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) = \frac{1 - 8x^3}{x^2}, \quad x \neq 0.$$



(a) Solve the equation $\mathrm{f}(x) = 0$. [3]

(b) Find $\int \mathrm{f}(x)\,\mathrm{d}x$. [3]

(c) Find the area of the shaded region bounded by the curve $y = \mathrm{f}(x)$, the x-axis and the line $x = 2$. [3]

Total: 9

8. (a) Given that $\sin(\theta) = 2 - \sqrt{2}$, find the value of $\cos^2(\theta)$ in the form $a + b\sqrt{2}$ where a and b are integers. [3]

   (b) Find, in terms of π, all values of x in the interval $0 \leq x < \pi$ for which [7]

$$\cos\left(2x - \frac{\pi}{6}\right) = \frac{1}{2}.$$

Total: 10

9. The second and fifth terms of a geometric series are -48 and 6 respectively.

   (a) Find the first term and the common ratio of the series. [5]

   (b) Find the sum to infinity of the series. [2]

   (c) Show that the difference between the sum of the first n terms of the series and its sum to infinity is given by 2^{6-n}. [5]

Total: 12