Solomon Practice Paper

Core Mathematics 2K

Time allowed: 90 **minutes**

Question	Points	Score
1	4	
2	4	
3	7	
4	9	
5	9	
6	10	
7	10	
8	11	
9	11	
Total:	75	

Centre: www.CasperYC.club

Name:

Teacher:

How I can achieve better:

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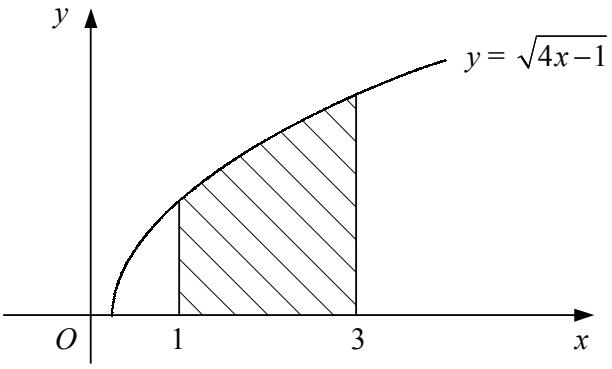
Last updated: May 5, 2023

1. Evaluate [4]

$$\int_1^4 x^2 - 5x + 4 \, \mathrm{d}x.$$

2. Figure shows the curve with equation $y = \sqrt{4x - 1}$. [4]



Use the trapezium rule with five equally-spaced ordinates to estimate the area of the shaded region bounded by the curve, the x-axis and the lines $x = 1$ and $x = 3$.

3. (a) Given that $y = \log_2(x)$, find expressions in terms of y for [4]
   i. $\log_2\left(\frac{x}{2}\right)$,
   ii. $\log_2\left(\sqrt{x}\right)$.

   (b) Hence, or otherwise, solve the equation [3]

$$2\log_2\left(\frac{x}{2}\right) + \log_2\left(\sqrt{x}\right) = 8.$$

Total: 7

4.

$$\mathrm{f}(x) = 2 - x - x^3.$$

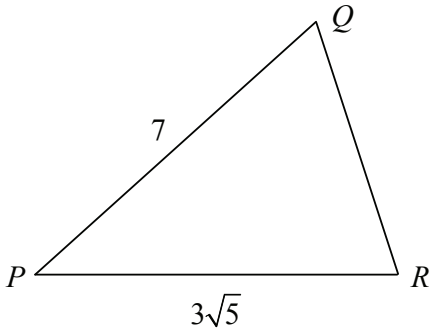
(a) Show that $\mathrm{f}(x)$ is decreasing for all values of x. [4]

(b) Verify that the point $(1, 0)$ lies on the curve $y = \mathrm{f}(x)$. [1]

(c) Find the area of the region bounded by the curve $y = \mathrm{f}(x)$ and the coordinate axes. [4]

Total: 9

5. Figure shows triangle PQR in which $PQ = 7$ and $PR = 3\sqrt{5}$.



Given that $\sin(\angle QPR) = \frac{2}{3}$ and that $\angle QPR$ is acute,

(a) find the exact value of $\cos(\angle QPR)$ in its simplest form, [2]

(b) show that $QR = 2\sqrt{6}$, [4]

(c) find $\angle PQR$ in degrees to 1 decimal place. [3]

Total: 9

6. The polynomial $\mathrm{p}(x)$ is defined by

$$\mathrm{p}(x) = 2x^3 + x^2 + ax + b,$$

where a and b are constants.

Given that when $\mathrm{p}(x)$ is divided by $(x + 2)$ there is a remainder of 20,

(a) find an expression for b in terms of a. [2]

Given also that $(x + 3)$ is a factor of $\mathrm{p}(x)$,

(b) find the values of a and b, [4]

(c) fully factorise $\mathrm{p}(x)$. [4]

Total: 10

7. (a) Find, to 2 decimal places, the values of x in the interval $0 \leq x < 2\pi$ for which [4]

$$\tan\left(x + \frac{\pi}{4}\right) = 3.$$

(b) Find, in terms of π, the values of y in the interval $0 \leq y < 2\pi$ for which $2\sin(y) = \tan(y)$. [6]

Total: 10

8. The point A has coordinates $(4, 6)$.

Given that OA, where O is the origin, is a diameter of circle C,

(a) find an equation for C. [4]

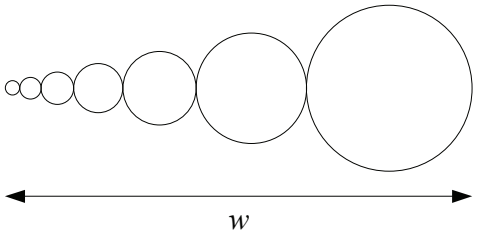
Circle C crosses the x-axis at O and at the point B.

(b) Find the coordinates of B. [2]

(c) Find an equation for the tangent to C at B, giving your answer in the form $ax + by = c$, where a, b and c are integers. [5]

Total: 11

9. Figure shows part of a design being produced by a computer program.



The program draws a series of circles with each one touching the previous one and such that their centres lie on a horizontal straight line.

The radii of the circles form a geometric sequence with first term 1 mm and second term 1.5 mm. The width of the design is w as shown.

(a) Find the radius of the fourth circle to be drawn. [2]

(b) Show that when eight circles have been drawn, $w = 98.5$ mm to 3 significant figures. [4]

(c) Find the total area of the design in square centimetres when ten circles have been drawn. [5]

Total: 11