Solomon Practice Paper

Pure Mathematics 3B

Time allowed: 90 **minutes**

Centre: www.CasperYC.club

Name:

Teacher:

Question	Points	Score
1	5	
2	7	
3	9	
4	9	
5	10	
6	10	
7	12	
8	13	
Total:	75	

How I can achieve better:

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1. Given that [5]

$$\frac{3x^2+5x+13}{(x^2+2)(x-3)} \equiv \frac{Ax+B}{x^2+2} + \frac{C}{x-3}$$

find the values of the constants A, B and C.

2. (a) Find $\int 6xe^{3x}\,dx$. [4]

   (b) Find the general solution of the differential equation [3]

$$\frac{dy}{dx} = 6xe^{3x+y}.$$

Total: 7

3. Air is pumped into a balloon such that its volume increases at the rate of 75 cm^3 per second. It is assumed that the balloon is spherical at all times.

   (a) Find, in terms of π, the rate at which the radius of the balloon is increasing when the radius is 5 cm. [4]

   (b) Given that the balloon was initially empty, show that one minute after the pumping begins the radius is increasing at the rate of $\frac{1}{12}\pi^{-\frac{1}{3}}$ cm per second. [5]

Total: 9

4. (a) Given that $|x| < 1$, express $(1+x)^{-\frac{1}{2}}$ as a series in ascending powers of x, as far as the term in x^3. You should simplify the coefficients in your series. [4]

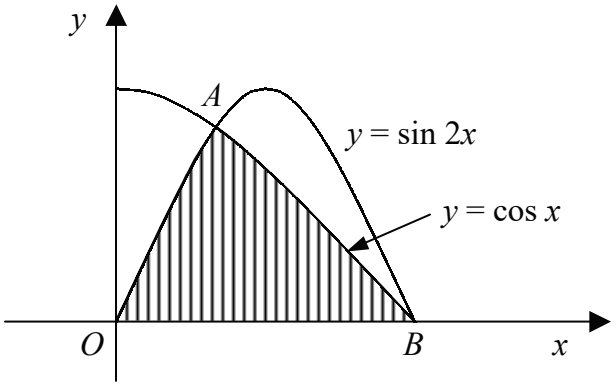
   (b) Hence, express [5]

$$\frac{8x}{\sqrt{4-x}}$$

   as a series in ascending powers of x, as far as the term in x^3, and state the set of values of x for which your series is valid.

Total: 9

5. Figure shows part of the curves $y = \cos(x)$ and $y = \sin(2x)$ for $x > 0$.



The curves intersect at the points A and B.

(a) Find the coordinates of A and B. [5]

(b) Show that the area of the shaded region bounded by the two curves and the x-axis is $\frac{3}{4}$. [5]

Total: 10

6. (a) Write down in cartesian form the equation of a circle with centre $(-4, 3)$ and a radius of 5. [2]

   (b) Find, in the form $ax + by + c = 0$, the equation of the normal to the circle at the point $(-1, 7)$. [8]

Total: 10

7. The line l_1 passes through the points with position vectors $(6\mathbf{i}+\mathbf{j}+\mathbf{k})$ and $(12\mathbf{i}+\mathbf{j}-11\mathbf{k})$ relative to a fixed origin, O.

   (a) Find an equation of the line l_1 in vector form. [3]

   The line l_2 has the equation

$$\mathbf{r} = 4\mathbf{i} - 3\mathbf{j} + 7\mathbf{k} + \mu(2\mathbf{i} + 2\mathbf{j} - 5\mathbf{k}).$$

   (b) Show that the lines l_1 and l_2 intersect and find the position vector of their point of intersection, P. [5]

   The line l_3 is perpendicular to l_1 and intersects lines l_1 and l_2 at Q and R respectively.

   (c) Find in degrees, correct to 1 decimal place, the size of angle PRQ. [4]

Total: 12

8. The curve C has parametric equations

$$x = \frac{3}{t}, \quad \text{and} \quad y = 2t^2, \quad t \neq 0.$$

(a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in terms of t. [3]

The point A on C has parameter $t = 1$.

(b) Show that the equation of the tangent to C at the point A is [4]

$$4x + 3y - 18 = 0.$$

The tangent to C at the point A meets the curve again at the point B.

(c) Find the coordinates of B. [6]

Total: 13