Pearson Edexcel Level 3

GCE Mathematics 9MA0

Practice Paper D

Pure Mathematics

Time allowed: 2 **hours**

Centre:

Name:

Teacher:

Question	Points	Score
1	5	
2	10	
3	6	
4	6	
5	5	
6	7	
7	7	
8	8	
9	8	
10	9	
11	5	
12	10	
13	14	
Total:	100	

1. Given that [5]

$$\frac{x^2-36}{x^2-11x+30} \times \frac{25-x^2}{Ax^2+Bx+C} \times \frac{6x^2+7x-3}{3x^2+17x-6} \equiv \frac{x+5}{6-x},$$

find the values of the constants A, B and C, where A, B and C are integers.

2. (a) Use proof by contradiction to show that if n^2 is an even integer then n is also an even integer. [4]

   (b) Prove that $\sqrt{2}$ is irrational. [6]

Total: 10

3. Given that in the expansion of $\frac{1}{(1+ax)^2}$ the coefficient of the x^2 term is 75, find

   (a) the possible values of a, [4]

   (b) the corresponding coefficients of the x^3 term. [2]

Total: 6

4. (a) Given that $f(x) = \sin(x)$, show that [4]

$$f'(x) = \lim_{h \to 0} \left(\frac{\cos(h-1)}{h} \sin(x) + \frac{\sin(h)}{h} \cos(x) \right)$$

(b) Hence prove that $f'(x) = \cos(x)$. [2]

Total: 6

5. Given that [5]

$$\int_a^4 (10-2x)^4 \, \mathrm{d}x = \frac{211}{10},$$

find the value of a.

6.

$$f(x) = x^4 - 8x^2 + 2.$$

(a) Show that the equation $f(x) = 0$ can be written as $x = \sqrt{ax^4 + b}, x > 0$, where a and b are constants to be found. [2]

(b) Let $x_0 = 1.5$. Use the iteration formula $x_{n+1} = \sqrt{ax_n^4 + b}$, together with your values of a and b from part (a), to find, to 4 decimal places, the values of x_1, x_2, x_3 and x_4. [2]

(c) A root of $f(x) = 0$ is α. By choosing a suitable interval, prove that $\alpha = -2.782$ to 3 decimal places. [3]

Total: 7

7. The functions f and g are defined by $f(x) = e^{2x} + 4, x \in \mathbb{R}$ and $g(x) = \ln(x + 1), x \in \mathbb{R}, x > -1$.

   (a) Find $fg(x)$ and state its range. [4]

   (b) Solve $fg(x) = 85$. [3]

Total: 7

8. For an arithmetic sequence $a_4 = 98$ and $a_{11} = 56$.

   (a) Find the value of the 20th term. [4]

   (b) Given that the sum of the first n terms is 78, find the value of n. [4]

Total: 8

9. Figure 1 shows the right-angled triangles $\triangle ABC, \triangle ABD$ and $\triangle BDC$, with $AB = 1$ and $\angle BAD = \theta$. [8]

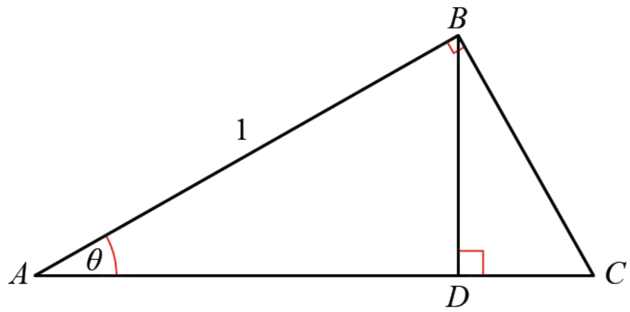

Figure 1:

Prove that $1 + \tan^2(\theta) = \sec^2(\theta)$.

10. A particle of mass 3kg is acted on by three forces, $F_1 = (2i + 6j - 3k)$N, $F_2 = (7i + 8k)$N and $F_3 = (-3i - 3j - 2k)$N.

    (a) Find the resultant force R acting on the particle. [2]

    (b) Find the acceleration of the particle, giving your answer in the form $(pi + qj + rk)\text{ms}^{-2}$. [2]

    (c) Find the magnitude of the acceleration. [2]

    (d) Given that the particle starts at rest, find the exact distance travelled by the particle in the first 10s. [3]

Total: 9

11. Find the values of the constants A, B, C, D and E in the following identity: [5]

$$5x^4 - 4x^3 + 17x^2 - 5x + 7 \equiv (Ax^2 + Bx + C)(x^2 + 2) + Dx + E.$$

12.

$$f(x) = \frac{21 - 14x}{(1 - 4x)(2x + 3)}, \quad x \neq \frac{1}{4}, x \neq -\frac{3}{2}.$$

(a) Given that $f(x) = \frac{A}{1-4x} + \frac{B}{2x+3}$, find the values of the constants A and B. [5]

(b) Find the exact value of $\int_{-1}^{0} f(x)\,\mathrm{d}x$. [5]

Total: 10

13. Figure 2 shows the curve C with parametric equations $x = t + 2, y = \frac{t-1}{t-2}, t \neq -2$. The curve passes through the x-axis at P.

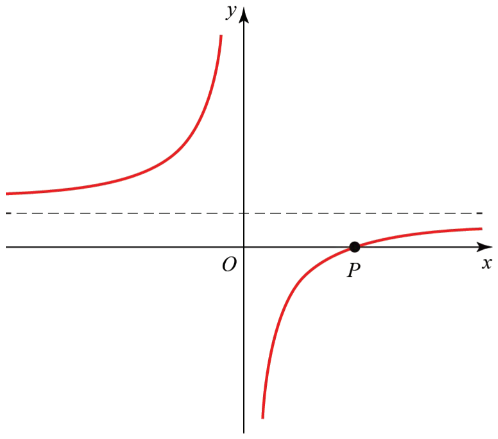

Figure 2:

(a) Find the coordinate of P. [2]

(b) Find the cartesian equation of the curve. [2]

(c) Find the equation of the normal to the curve at the point $t = -1$. Give your answer in the form $ax + by + c = 0$. [6]

(d) Find the coordinates of the point where the normal meets C. [4]

Total: 14