Pearson Edexcel

AS Mathematics 8MA0

Practice Paper D

Pure Mathematics

Time allowed: 2 hours

Centre:

Name:

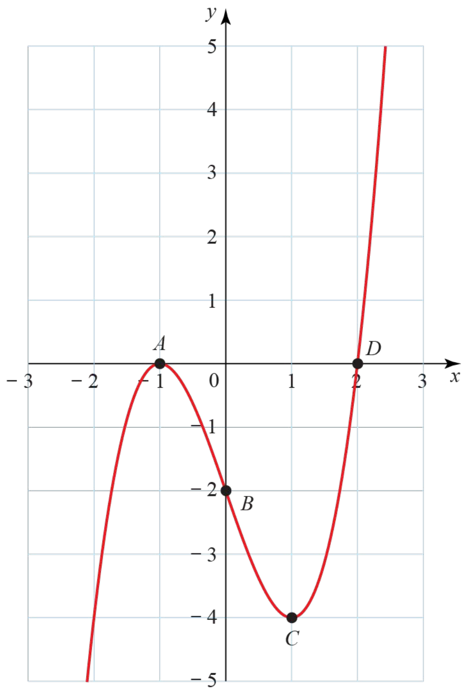
Teacher:

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

1.

$$f(x) = x^3 - 3x - 2.$$

The figure below shows a sketch of part of the curve with equation $y = f(x)$.



(a) On a separate set of axes, sketch the curve with equation $y = f(2x)$ showing the location and coordinates of the images of points A, B, C and D. [2]

(b) On a separate set of axes, sketch the curve with equation $y = f(-x)$ showing the location and coordinates of the images of points A, B, C and D. [2]

Total: 4

2. Find [5]

$$\int (5 - 3\sqrt{x})^2 \, dx.$$

3. Solve algebraically, showing each step of your working, the equation [5]

$$(8^{x-1})^2 - 18(8^{x-1}) + 32 = 0.$$

4. A buoy is a device which floats on the surface of the sea and moves up and down as waves pass. For a certain buoy, its height, above its position in still water, y in metres, is modelled by a sine function of the form $y = \frac{1}{2}\sin(180t^\circ)$, where t is the time in seconds.

   (a) Sketch a graph showing the height of the buoy above its still water level for $0 \leq t \leq 10$ showing the coordinates of points of intersection with the t-axis. [3]

   (b) Write down the number of times the buoy is 0.4 m above its still water position during the first 10 seconds. [1]

   (c) Give one reason why this model might not be realistic. [1]

Total: 5

5. [5]

$$f(x) = x^3 - 4x^2 - 35x + 20.$$

Find the set of values of x for which $f(x)$ is increasing.

6. The speed, v ms^{-1}, of a rollercoaster at time t s is given by [5]

$$v(t) = \frac{1}{20}\left(50\sqrt{t} + 20t^2 - t^3\right), \quad \text{where} \quad 0 \le t \le 20.$$

The distance, s m, travelled by the rollercoaster in the first 20s is given by $s = \int_0^{20} v(t)\,\mathrm{d}t$.

Find the value of s, giving your answer to 3 significant figures.

7.

$$f(x) = x^2 - (k+8)x + (8k+1).$$

(a) Find the discriminant of $f(x)$ in terms of k giving your answer as a simplified quadratic. [3]

(b) If the equation $f(x) = 0$ has two equal roots, find the possible values of k. [2]

(c) Show that when $k = 8, f(x) > 0$ for all values of x. [3]

Total: 8

8. The equations of two circles are $x^2 + 10x + y^2 - 12y = 3$ and $x^2 - 6x + y^2 - 2qy = 9$.

   (a) Find the centre and radius of each circle, giving your answers in terms of q where necessary. [6]

   (b) Given that the distance between the centres of the circles is $\sqrt{80}$, find the two possible values of q. [3]

Total: 9

9. The graph of $y = ab^x$ passes through the points $(2, 400)$ and $(5, 50)$.

   (a) Find the values of the constants a and b. [5]

   (b) Given that $ab^x < k$, for some constant $k > 0$, show that [4]

$$x > \frac{\log\left(\frac{1600}{k}\right)}{\log(2)},$$

   where log means log to any valid base.

Total: 9

(Q9 continued)

10. (a) Calculate the value of $-2\tan(-120°)$. [1]

(b) On the same set of axes sketch the graphs of $y = 2\sin(x - 60°)$ and $y = -2\tan(x)$, in the interval $-180° \leq x \leq 180°$, showing the coordinates of points of intersection with the coordinate axes in exact form. [7]

(c) Explain how you can use the graph to identify solutions to the equations [1]

$$y = 2\sin(x - 60°) + 2\tan(x) = 0, \quad -180° \leq x \leq 180°.$$

(d) Write down the number of solutions of the above equation. [1]

Total: 10

(Q10 continued)

11. A curve C has equation $y = x^3 - x^2 - x + 2$.

    The point P has x-coordinate 2.

    (a) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in terms of x. [2]

    (b) Find the equation of the tangent to the curve C at the point P. [4]

    (c) The normal to C at P intersects the x-axis at A. Find the coordinates of A. [4]

    Total: 10

(Q11 continued)

12.

$$f(x) = x^3 + x^2 + px + q,$$

where p and q are constants. Given that $f(5) = 0$ and $f(-3) = 8$,

(a) find the values of p and q, [7]

(b) factorise $f(x)$ completely. [5]

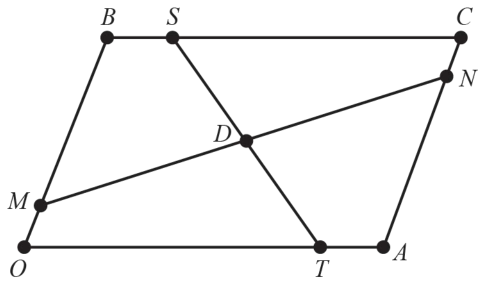
Total: 12

(Q12 continued)

13. $OACB$ is a parallelogram. $\overrightarrow{OA} = a$ and $\overrightarrow{OB} = b$.

The points M, S, N and T divide OB, BC, CA and AO in the ratio $1:4$ respectively.

The lines ST and MN intersect at the point D.



(a) Express $\overrightarrow{MN}$ in terms of a and b. [2]

(b) Express $\overrightarrow{ST}$ in terms of a and b. [2]

(c) Show that the lines MN and ST bisect one another. [9]

Total: 13

(Q13 continued)