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Mathematics  
Higher  
Paper 2  
Practice Paper C

Time allowed  
1 hour 10 minutes

NATIONAL  
QUALIFICATIONS

**Read carefully**

- 1 **Calculators may be used in this paper.**
- 2 Full credit will be given only where the solution contains appropriate working.
- 3 Answers obtained by readings from scale drawings will not receive any credit.

## FORMULAE LIST

### Circle:

The equation  $x^2 + y^2 + 2gx + 2fy + c = 0$  represents a circle centre  $(-g, -f)$  and radius  $\sqrt{g^2 + f^2 - c}$ .

The equation  $(x - a)^2 + (y - b)^2 = r^2$  represents a circle centre  $(a, b)$  and radius  $r$ .

**Scalar Product :**  $\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta$ , where  $\theta$  is the angle between  $\mathbf{a}$  and  $\mathbf{b}$ .

$$\text{or } \mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2 + a_3 b_3, \text{ where } \mathbf{a} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \text{ and } \mathbf{b} = \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}.$$

**Trigonometric formulae:**  $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$= 2 \cos^2 A - 1$$

$$= 1 - 2 \sin^2 A$$

**Table of standard derivatives :**

$f(x)$	$f'(x)$
$\sin ax$	$a \cos ax$
$\cos ax$	$-a \sin ax$

**Table of standard integrals :**

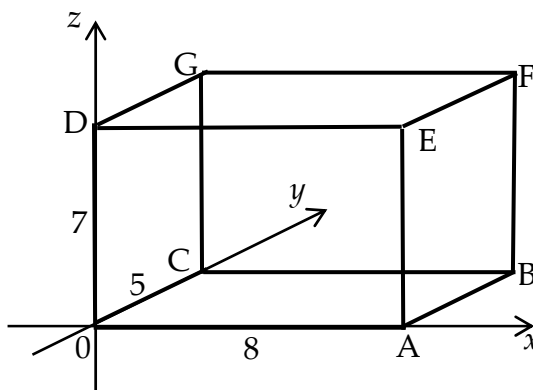
$f(x)$	$\int f(x) dx$
$\sin ax$	$-\frac{1}{a} \cos ax + C$
$\cos ax$	$\frac{1}{a} \sin ax + C$

ALL questions should be attempted.

Marks

1. (a) Given that  $(x+1)$  is a factor of  $2x^3 + 3x^2 + kx - 6$ , find the value of  $k$ . 3  
(b) Hence, or otherwise, solve  $2x^3 + 3x^2 + kx - 6 = 0$ . 4

2. OABC,DEFG is a rectangular prism as show.



OA is 8 units long, OC is 5 units and OD is 7 units.

- (a) Write down the coordinates of B and G. 2  
(b) Calculate the size of angle BEG. 6
3. A circle, centre C, has equation  $x^2 + y^2 - 4x - 2y - 20 = 0$ .
- (a) Find the centre C and radius of this circle. 2  
(b) (i) Show that the point P(5, -3) lies on the circumference of the circle.  
(ii) Find the equation of radius CP. 4  
(c) Find the equation of the chord which passes through (7, 1) and is perpendicular to radius CP. 3
4. Solve  $3\cos 2x = 11\cos x - 6$  for  $0 \leq x < 2\pi$ . 6

5. (a) Diagram 1 shows part of the graph with equation  $y = x^3 - 5x^2 + 2x + 8$ .

Calculate the shaded area.

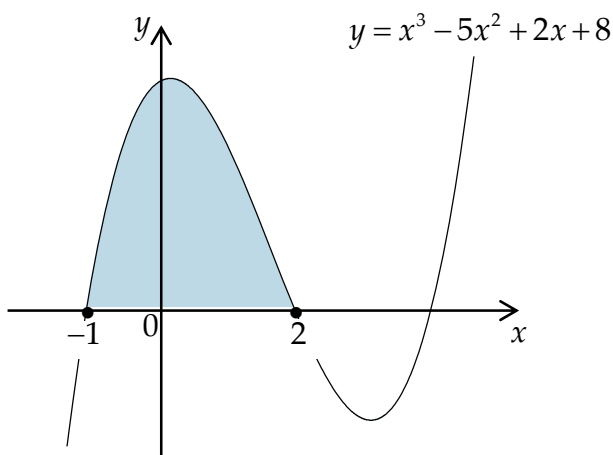


Diagram 1

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- (b) Given that

$$\int_{-1}^p (x^3 - 5x^2 + 2x + 8) dx = 12 \cdot 13$$

find the total shaded area in diagram 2.

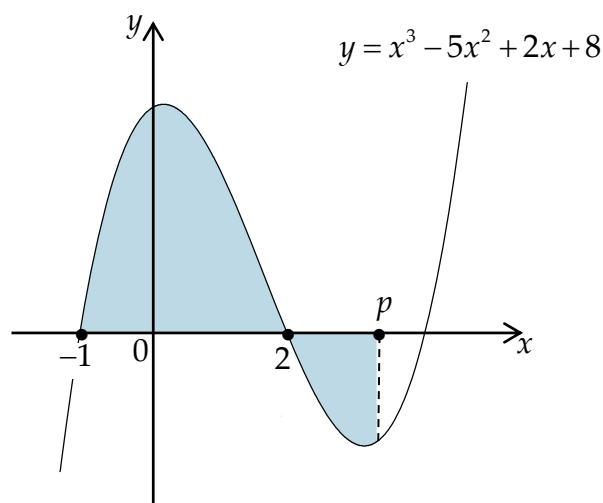


Diagram 2

2

6. Find the smallest integer value of  $c$  for which

$$g(x) = (x-2)(x^2 - 2x + c)$$

has only one real root.

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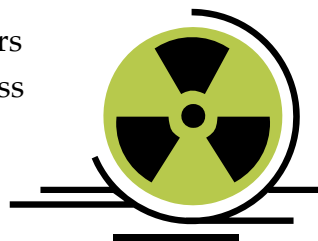
7. (a) Write  $2\sin x + \sqrt{5}\cos x$  in the form  $k\sin(x+a)$ , where  $k > 0$  and  $0 \leq a < \frac{\pi}{2}$ .

4

- (b) Sketch the graph of  $y = 4\sin x + 2\sqrt{5}\cos x$  for  $0 \leq x \leq 2\pi$ .

4

8. For a particular radioactive isotope, the mass of the original isotope remaining,  $m$  grams, after time  $t$  years is given by  $m = m_0 e^{-0.18t}$  where  $m_0$  is the original mass of the isotope.



- (a) If the original mass is 1000g, find the mass of the original isotope remaining after 20 years. 2

The half-life of the isotope is the time taken for half the original mass to decay.

- (b) Find the half life of this isotope. 3

9. Find  $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \left( \frac{\sin 4x}{\sin 2x} \right) dx$ . 5

**End of Question Paper**