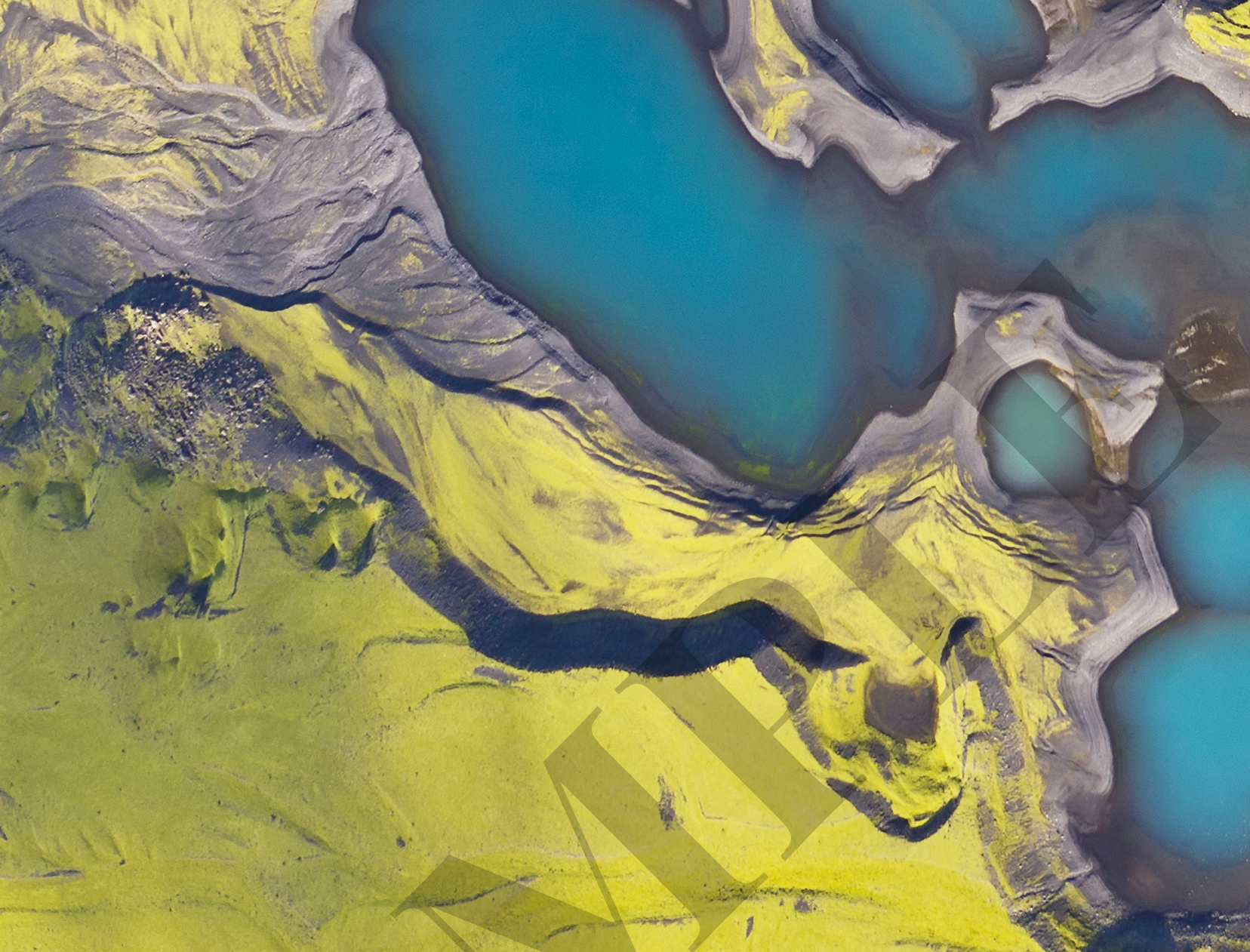




MATHEMATICS

PEARSON EDEXCEL INTERNATIONAL A LEVEL

PURE MATHEMATICS 1

TEACHER RESOURCE PACK



Indices

Gold

- a** Express 4^{5x+3} in the form 2^y , giving y in the form $ax + b$, where a and b are constants.
- b** Solve the equation $3^{0.5x-1} = \frac{\sqrt{3}}{81}$.

Silver

Let $A = \frac{1}{5}x^2$ and $B = \sqrt{5}x^{-\frac{1}{2}}$.

- a** Simplify the following expression fully:

$$A^2$$

- b** Hence, or otherwise, find $(AB)^2$.

Bronze

- a** Given that $5^x = 125$, find x .
- b** Simplify the following expression fully:

$$x^2 \left(5x^{-\frac{1}{2}} \right)^3$$

Gold

a	Rewrite $4^{5x+3} = 2^{2(5x+3)}$ $= 2^{10x+6}$ Compare indices $2^{10x+6} = 2^y$ $y = 10x + 6$, so $a = 10$ and $b = 6$	M1 A1 [2]
b	$\frac{\sqrt{3}}{81} = \frac{3^{\frac{1}{2}}}{3^4}$ $= 3^{-3.5}$ $3^{0.5x-1} = 3^{-3.5}$ Solve for x $0.5x - 1 = -3.5$ $x = -5$	M1 A1 M1, A1 [4] 6 marks

Silver

a	$A^2 = \left(\frac{1}{5}x^2\right)^2$ $= \frac{1}{25}x^4$	M1 A1 [2]
b	$(AB)^2 = A^2B^2$ $= \frac{1}{25}x^4 \left(\sqrt{5}x^{-\frac{1}{2}}\right)^2$ $= \frac{1}{25}x^4(5x^{-1})$ $= \frac{1}{5}x^3$	M1 M1 A1 [3] 5 marks

Bronze

a	$x = 3$, since $5 \times 5 \times 5 = 125$	B1 [1]
b	$\left(5x^{-\frac{1}{2}}\right)^3 = 5^3 x^{-\frac{3}{2}}$ So $x^2 \left(5x^{-\frac{1}{2}}\right)^3 = x^2 5^3 x^{-\frac{3}{2}}$ $= 5^3 x^{2-\frac{3}{2}}$ $= 125x^{\frac{1}{2}}$	M1 M1 M1 A1 [4] 5 marks

1. Given that $y = 2(x-3)(x+5) - \sqrt{x}$, $x > 0$, find in their simplest form:

(a) $\frac{dy}{dx}$

(3)

(b) $\int y \, dx$.

(3)

2. The function $f(x)$ is defined as

$$f(x) = x^2 - 7x + 11, \quad x \in \mathbb{P}$$

- (a) Express $f(x)$ in the form $(x+a)^2 = b$, where a and b are constants to be found.

(2)

- (b) Hence, or otherwise, find the exact solutions of the equation $f(x) = 0$

(2)

- (c) Sketch the curve $y = f(x)$, clearly showing the intersections with the coordinate axes and stating the coordinates of the minimum point P .

(3)

3. Solve the simultaneous equations

$$\begin{aligned} 2x - y &= 3 \\ y^2 - x^2 - xy &= 3 \end{aligned}$$

giving your answers in the form $a + b\sqrt{c}$, where a , b and c are constants.

(6)

4. (a) On the same axes, sketch the graphs of $y = 4x + 5$ and $y = 2x^2 + 3x - 5$, showing the coordinates of all points at which each graph crosses the coordinate axes.

(4)

- (b) On your sketch, show, by shading, the region R defined by the inequalities

$$y < 4x + 5 \quad \text{and} \quad y > 2x^2 + 3x - 5$$

(1)

- (c) Hence, or otherwise, find the set of values of x for which $2x^2 - x - 10 < 0$

(3)

Chapter 1

- P** 1. Do not use your calculator for this question.

Factorise completely:

a $2x^2 - 18$ (2)

b $2x^3 - x^2 - 6x$ (2)

c $x^4 + x^2 - 20$ (2)

d $x + 2x^{\frac{1}{2}} + 1$ (2)

Sections 1.3, 1.4

2. Do not use your calculator for this question.

Evaluate:

a $144^{\frac{1}{2}}$ (1)

b $25^{\frac{3}{2}}$ (1)

c $16^{-\frac{3}{4}}$ (2)

Section 1.4

- E** 3. Given that $y = 25x^3$, express each of the following in the form kx^n , where k and n are constants.

a $y^{\frac{1}{2}}$ (1)

b $10xy^{-1}$ (2)

c $5y^{\frac{3}{2}}$ (2)

Section 1.4

- E** 4. Express $(2 - \sqrt{8})^2$ in the form $a + b\sqrt{2}$, where a and b are integers. (2)

Section 1.5

- E** 5. Expand the following and simplify if possible:

a $(3 - \sqrt{11})(4 + \sqrt{11})$ (2)

b $(2 - \sqrt{5})(3 - \sqrt{2})$ (2)

Section 1.5

- E** 6. Express $64^{\frac{1}{2}}$ as a power of 2. (2)

Sections 1.1, 1.4

7. Simplify

$$\frac{4 - 3\sqrt{7}}{\sqrt{7} - 3}$$

giving your answer in the form $p + q\sqrt{7}$, where p and q are rational numbers. (4)

Section 1.6

Chapter 2

- E/P** 8. Given that $y = 3^x$:

a Express 9^x in terms of y . (2)

b Hence, or otherwise, solve the following equation:

$$9^x - 10(3^x) + 9 = 0 \quad (5)$$

Sections 1.1, 2.1

- E/P** 9. The function $g(x)$ is defined as

$$g(x) = x^8 - 4x^7 - 12x^6, \quad x \in \mathbb{R}$$

a Write $g(x)$ in the form $x^k(x + a)(x + b)$, where a , b and k are integers. (1)

b Hence find the three roots of $g(x)$. (1)

Section 2.3

Exercise 1A

$$1 \quad \mathbf{a} \quad x^3 \times x^4 = x^{3+4} \\ = x^7$$

$$\mathbf{b} \quad 2x^3 \times 3x^2 = 2 \times 3 \times x^{3+2} \\ = 6x^5$$

$$\mathbf{c} \quad \frac{k^3}{k^2} = k^{3-2} \\ = k$$

$$\mathbf{d} \quad \frac{4p^3}{2p} = \frac{4}{2} \times \frac{p^3}{p} \\ = 2 \times p^{3-1} \\ = 2p^2$$

$$\mathbf{e} \quad \frac{3x^3}{3x^2} = \frac{3}{3} \times \frac{x^3}{x^2} \\ = 1 \times x^{3-2} \\ = x$$

$$\mathbf{f} \quad (y^2)^5 = y^{2 \times 5} \\ = y^{10}$$

$$\mathbf{g} \quad 10x^5 \div 2x^3 = 5x^{5-3} \\ = 5x^2$$

$$\mathbf{h} \quad (p^3)^2 \div p^4 = p^{6 \div 4} \div p^4 \\ = p^{6-4} \\ = p^2$$

$$\mathbf{i} \quad (2a^3)^2 \div 2a^3 = 2^2 \times a^{6 \div 2} \div 2a^3 \\ = 4a^3 \div 2a^3 \\ = 2a^{3-3} \\ = 2a^0 \\ = 2$$

$$\mathbf{j} \quad 8p^4 \div 4p^3 = 2p^{4-3} \\ = 2p^1 \\ = 2p$$

$$\mathbf{k} \quad 2a^4 \times 3a^5 = 2 \times 3 \times a^4 \times a^5 \\ = 6 \times a^{4+5} \\ = 6a^9$$

$$\mathbf{l} \quad \frac{21a^3b^7}{7ab^4} = \frac{21}{7} \times \frac{a^3}{a} \times \frac{b^7}{b^4} \\ = 3a^{3-1} \times b^{7-4} \\ = 3a^2b^3$$

$$\mathbf{m} \quad 9x^2 \times 3(x^2)^3 = 9 \times 3 \times x^2 \times x^{2 \times 3} \\ = 27x^{2+6} \\ = 27x^8$$

$$\mathbf{n} \quad 3x^3 \times 2x^2 \times 4x^6 = 3 \times 2 \times 4 \times x^{3+2+6} \\ = 24x^{11}$$

$$\mathbf{o} \quad 7a^4 \times (3a^4)^2 = 7a^4 \times 9a^8 \\ = 63a^{12}$$

$$\mathbf{p} \quad (4y^3)^3 \div 2y^3 = 64y^9 \div 2y^3 \\ = 32y^6$$

$$\mathbf{q} \quad 2a^3 \div 3a^2 \times 6a^5 = 2 \div 3 \times 6 \times a^{3-2+5} \\ = 4a^6$$

$$\mathbf{r} \quad 3a^4 \times 2a^5 \times a^3 = 3 \times 2 \times a^{4+5+3} \\ = 6a^{12}$$

$$2 \quad \mathbf{a} \quad 9(x-2) = 9x - 18$$

$$\mathbf{b} \quad x(x+9) = x^2 + 9x$$

$$\mathbf{c} \quad -3y(4-3y) = -12y + 9y^2$$

$$\mathbf{d} \quad x(y+5) = xy + 5x$$

$$\mathbf{e} \quad -x(3x+5) = -3x^2 - 5x$$

$$\mathbf{f} \quad -5x(4x+1) = -20x^2 - 5x$$

$$\mathbf{g} \quad (4x+5)x = 4x^2 + 5x$$

$$\mathbf{h} \quad -3y(5-2y^2) = -15y + 6y^3$$

$$\mathbf{i} \quad -2x(5x-4) = -10x^2 + 8x$$

$$\mathbf{j} \quad (3x-5)x^2 = 3x^3 - 5x^2$$

$$\mathbf{k} \quad 3(x+2) + (x-7) = 3x + 6 + x - 7 \\ = 4x - 1$$

$$\mathbf{l} \quad 5x - 6 - (3x - 2) = 5x - 6 - 3x + 2 \\ = 2x - 4$$

$$\mathbf{m} \quad 4(c+3d^2) - 3(2c+d^2) \\ = 4c + 12d^2 - 6c - 3d^2 \\ = -2c + 9d^2$$

$$\begin{aligned}
 2 \quad n \quad & (r^2 + 3t^2 + 9) - (2r^2 + 3t^2 - 4) \\
 & = r^2 + 3t^2 + 9 - 2r^2 - 3t^2 + 4 \\
 & = 13 - r^2
 \end{aligned}$$

$$o \quad x(3x^2 - 2x + 5) = 3x^3 - 2x^2 + 5x$$

$$p \quad 7y^2(2 - 5y + 3y^2) = 14y^2 - 35y^3 + 21y^4$$

$$q \quad -2y^2(5 - 7y + 3y^2) = -10y^2 + 14y^3 - 6y^4$$

$$\begin{aligned}
 r \quad & 7(x - 2) + 3(x + 4) - 6(x - 2) \\
 & = 7x - 14 + 3x + 12 - 6x + 12 \\
 & = 4x + 10
 \end{aligned}$$

$$\begin{aligned}
 s \quad & 5x - 3(4 - 2x) + 6 = 5x - 12 + 6x + 6 \\
 & = 11x - 6
 \end{aligned}$$

$$\begin{aligned}
 t \quad & 3x^2 - x(3 - 4x) + 7 = 3x^2 - 3x + 4x^2 + 7 \\
 & = 7x^2 - 3x + 7
 \end{aligned}$$

$$\begin{aligned}
 u \quad & 4x(x + 3) - 2x(3x - 7) \\
 & = 4x^2 + 12x - 6x^2 + 14x \\
 & = 26x - 2x^2
 \end{aligned}$$

$$\begin{aligned}
 v \quad & 3x^2(2x + 1) - 5x^2(3x - 4) \\
 & = 6x^3 + 3x^2 - 15x^3 + 20x^2 \\
 & = 23x^2 - 9x^3
 \end{aligned}$$

$$\begin{aligned}
 3 \quad a \quad & \frac{6x^4 + 10x^6}{2x} = \frac{6x^4}{2x} + \frac{10x^6}{2x} \\
 & = 3x^{4-1} + 5x^{6-1} \\
 & = 3x^3 + 5x^5
 \end{aligned}$$

$$\begin{aligned}
 b \quad & \frac{3x^5 - x^7}{x} = \frac{3x^5}{x} - \frac{x^7}{x} \\
 & = 3x^{5-1} - x^{7-1} \\
 & = 3x^4 - x^6
 \end{aligned}$$

$$\begin{aligned}
 c \quad & \frac{2x^4 - 4x^2}{4x} = \frac{2x^4}{4x} - \frac{4x^2}{4x} \\
 & = \frac{1}{2}x^{4-1} - x^{2-1} \\
 & = \frac{x^3}{2} - x
 \end{aligned}$$

$$\begin{aligned}
 3 \quad d \quad & \frac{8x^3 + 5x}{2x} = \frac{8x^3}{2x} + \frac{5x}{2x} \\
 & = 4x^{3-1} + \frac{5}{2}x^{1-1} \\
 & = 4x^2 + \frac{5}{2}
 \end{aligned}$$

$$\begin{aligned}
 e \quad & \frac{7x^7 + 5x^2}{5x} = \frac{7x^7}{5x} + \frac{5x^2}{5x} \\
 & = \frac{7}{5}x^{7-1} + x^{2-1} \\
 & = \frac{7x^6}{5} + x
 \end{aligned}$$

$$\begin{aligned}
 f \quad & \frac{9x^5 - 5x^3}{3x} = \frac{9x^5}{3x} - \frac{5x^3}{3x} \\
 & = 3x^{5-1} - \frac{5}{3}x^{3-1} \\
 & = 3x^4 - \frac{5x^2}{3}
 \end{aligned}$$