

EXAM 1_2 (Polynomials- Surds)

1. Work out and simplify:

a)(1 p) $x(x + 2)^2 - x^2(x + 4) - 2(x + 2)(x - 2) =$

b)(0.75 p) $(x^2 - 2)(x^3 - x^2 + 2x - 1) =$

c) (0.75 p) $2x^3y^2(x^2y^2 - 3xy) - 2x^2(x^2y^3 + 2) =$

2. Rationalise and simplify:

a) (0.75 p) $\frac{\sqrt{2}}{3 - \sqrt{2}}$

b) (0.75 p) $\frac{2a}{\sqrt[3]{a^2}}$

c) (0.75 p) $\frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} - \sqrt{2}}$

3. Work out and simplify:

a)(0.75 p) $\sqrt{\sqrt{2500}} =$

b) (0.75 p) $\sqrt{2} \cdot \sqrt{8} \cdot \sqrt[3]{16} =$

c) (0.75p) $7\sqrt{\frac{2}{3}} - 3\sqrt{\frac{50}{12}} + \sqrt{\frac{2}{27}} - \frac{1}{5}\sqrt{\frac{8}{3}} =$

4. Factorise:

a)(0.5 p) $16x^4 - 8x^3 + x^2$

b) (1.25 p) $5x^3 - 20x^2 - 20x + 80$

cc) (1.25 p) $x^4 - 5x^2 + 4$

SOLUTION

1. Work out and simplify:

$$\begin{aligned} \text{a) } x(x+2)^2 - x^2(x+4) - 2(x+2)(x-2) &= x(x^2 + 4x + 4) - x^3 - 4x^2 - \\ &- 2(x^2 - 4) = x^3 + 4x^2 + 4x - x^3 - 4x^2 - 2x^2 + 8 = -2x^2 + 4x + 8 \end{aligned}$$

$$\begin{aligned} \text{b) } (x^2 - 2)(x^3 - x^2 + 2x - 1) &= x^5 - x^4 + 2x^3 - x^2 - 2x^3 + 2x^2 - 4x + 2 = \\ &= x^5 - x^4 + x^2 - 4x + 2 \end{aligned}$$

$$\begin{aligned} \text{c) } 2x^3y^2(x^2y^2 - 3xy) - 2x^2(x^2y^3 + 2) &= 2x^5y^4 - 6x^4y^3 - 2x^4y^3 - 4x^2 = \\ &= 2x^5y^4 - 8x^4y^3 - 4x^2 \end{aligned}$$

2. Rationalise and simplify:

$$\text{a) } \frac{\sqrt{2}}{3 - \sqrt{2}} = \frac{\sqrt{2}(3 + \sqrt{2})}{(3 - \sqrt{2})(3 + \sqrt{2})} = \frac{3\sqrt{2} + 2}{7}$$

$$\text{b) } \frac{2a}{\sqrt[3]{a^2}} = \frac{2a^3\sqrt[3]{a}}{\sqrt[3]{a^2}\sqrt[3]{a}} = \frac{2a^3\sqrt[3]{a}}{a} = 2\sqrt[3]{a}$$

$$\text{c) } \frac{\sqrt{5} + \sqrt{2}}{\sqrt{5} - \sqrt{2}} = \frac{(\sqrt{5} + \sqrt{2})(\sqrt{5} + \sqrt{2})}{(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})} = \frac{5 + 2\sqrt{5}\sqrt{2} + 2}{5 - 2} = \frac{7 + 2\sqrt{10}}{3}$$

3. Work out and simplify:

$$\text{a) } \sqrt{\sqrt{2500}} = \sqrt[4]{2^2 \cdot 5^4} = 5\sqrt[4]{2^2} = 5\sqrt{2}$$

$$\text{b) } \sqrt{2} \cdot \sqrt{8} \cdot \sqrt[3]{16} = \sqrt[6]{2^3} \sqrt[6]{(2^3)^3} \sqrt[6]{(2^4)^2} = \sqrt[6]{2^3 \cdot 2^9 \cdot 2^8} = \sqrt[6]{2^{20}} = \sqrt[3]{2^{10}} = 8\sqrt[3]{2}$$

$$\begin{aligned} \text{c) } 7\sqrt{\frac{2}{3}} - 3\sqrt{\frac{50}{12}} + \sqrt{\frac{2}{27}} - \frac{1}{5}\sqrt{\frac{8}{3}} &= 7\sqrt{\frac{2}{3}} - \frac{3 \cdot 5}{2}\sqrt{\frac{2}{3}} + \frac{1}{3}\sqrt{\frac{2}{3}} - \frac{2}{5}\sqrt{\frac{2}{3}} = \\ &= \left(7 - \frac{15}{2} + \frac{1}{3} - \frac{2}{5}\right)\sqrt{\frac{2}{3}} = \left(\frac{210 - 225 + 10 - 12}{30}\right)\sqrt{\frac{2}{3}} = -\frac{17}{30}\sqrt{\frac{2}{3}} \end{aligned}$$

4. Factorise:

$$a) 16x^4 - 8x^3 + x^2 = x^2(16x^2 - 8x + 1) = x^2(4x - 1)^2$$

$$b) 5x^3 - 20x^2 - 20x + 80 = 5(x^3 - 4x^2 - 4x + 16)$$

$$Div(16) = \pm 1, \pm 2, \pm 4, \pm 8, \pm 16$$

$$P(1) = 1 - 4 - 4 + 16 \neq 0 \quad P(-1) = -1 - 4 + 4 + 16 \neq 0$$

$$P(2) = 8 - 16 - 8 + 16 = 0$$

	1	-4	-4	+16
2		2	-4	-16
	1	-2	-8	0

$$x^2 - 2x - 8 = 0$$

$$x = \frac{2 \pm \sqrt{4 + 32}}{2} = \begin{cases} 4 \\ -2 \end{cases}$$

$$5x^3 - 20x^2 - 20x + 80 = 5(x - 2)(x + 2)(x - 4)$$

$$c) x^4 - 5x^2 + 4$$

$$Div(4) = \pm 1, \pm 2, \pm 4$$

$$P(1) = 1 - 5 + 4 = 0$$

$$P(-1) = 1 - 5 + 4 = 0$$

	1	0	-5	0	+4
1		1	1	-4	-4
	1	1	-4	-4	0
-1		-1	0	+4	
	1	0	-4	0	

$$x^2 - 4 = (x - 2)(x + 2)$$

$$x^4 - 5x^2 + 4 = (x - 1)(x + 1)(x - 2)(x + 2)$$



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