

Problem 1 Simplify (without calculator !)

[/ 4 marks]

$$1) \quad 8 \frac{\sqrt{72} \times \sqrt{12}}{\sqrt{32} \times \sqrt{27}} = \frac{8 \times 6\sqrt{2} \times 2\sqrt{3}}{4\sqrt{2} \times 3\sqrt{3}} = \frac{8 \times 6 \times 2}{4 \times 3} = \boxed{8}$$

$$2) \quad \frac{\frac{\sqrt{27}}{9}}{\frac{\sqrt{3}}{18}} = \frac{\sqrt{27}}{9} \times \frac{18}{\sqrt{3}} = \frac{18}{9} \times \frac{\sqrt{27}}{\sqrt{3}} = 2\sqrt{9} = \boxed{6}$$

$$3) \quad \frac{(7 + \sqrt{3})^2 + (7 - \sqrt{3})^2}{2^3} = \frac{2 \times (7^2 + 3)}{8} = \boxed{13}$$

Problem 2 Expand and simplify as far as possible

[/ 2 marks]

$$\frac{(3x^3)^2}{\sqrt{81x^{12}}} = \frac{9x^6}{9x^6} = \boxed{1} \quad (\text{for } x \neq 0)$$

Problem 3 Expand and then factorize the following

[/ 3 marks]

$$(x + 5y)^2 - (5x + y)^2 = x^2 + 10xy + 25y^2 - (25x^2 + 10xy + y^2) = -24x^2 + 24y^2 = \boxed{24(x - y)(x + y)}$$

Problem 4 Factorise

[/ 4 marks]

$$1) \quad 18x^8yz - 8x^2y^9z = 2x^2yz(9x^6 - 4x^8) = \boxed{2x^2yz(3x^3 - 2x^4)(3x^3 - 2x^4)}$$

$$2) \quad x^2y^2z^2 - 10xyz + 30 = (xyz - 3)(xyz - 10)$$

not factorisable because $\Delta = (-10)^2 - 4(1)(30) < 0$

Problem 5 Solve using the method of 'completing the square' to solve this equation

$$\begin{aligned} 2x^2 - 20x + 30 = 0 &\Rightarrow x^2 - 10x + 15 = 0 & [/ 5 \text{ marks}] \\ &\Rightarrow (x - 5)^2 - 25 + 10 = 0 \\ &\Rightarrow (x - 5)^2 = 15 \Rightarrow \boxed{x = 5 \pm \sqrt{15}} \end{aligned}$$

Problem 6

[/ 4 marks]

Assuming $a = \log_3(2)$ $b = \log_3(5)$ $c = \log_3(7)$,
give an expression for the three following terms, in terms of a, b, c .

$$1) \quad \log_3\left(\frac{49}{60}\right) = \boxed{2c - 2a - b - 1} \qquad 2) \quad \log_3\left(\frac{\sqrt{30}}{36}\right) = \boxed{\frac{a + b + 1}{2} - 2(a + 1)}$$

$$3) \quad \log_5(7) = \frac{\log_3(7)}{\log_3(5)} = \boxed{\frac{c}{a}}$$

tot: / 22 marks