

1. (12pts) Simplify and write the answer so all exponents are positive:

$$\begin{aligned} \text{a) } (6x^5y^{-4})^{-2}(2x^{-3}y^4)^5 &= 6^{-2} x^{5 \cdot (-2)} y^{(-4) \cdot (-2)} 2^5 x^{-3 \cdot 5} y^{4 \cdot 5} \\ &= \frac{1}{6^2} \cdot 32 x^{-10} y^8 x^{-15} y^{20} = \frac{32}{36} x^{-25} y^{28} = \frac{8y^{28}}{9x^{25}} \end{aligned}$$

$$\text{b) } \frac{(5w^4z^{-2})^3}{(10w^7z^{-4})^2} = \frac{5^3 w^{4 \cdot 3} z^{-2 \cdot 3}}{10^2 w^{7 \cdot 2} z^{-4 \cdot 2}} = \frac{\overset{5}{125} w^{12} z^{-6}}{\underset{4}{100} w^{14} z^{-8}} = \frac{5}{4} w^{-2} z^2 = \frac{5z^2}{4w^2}$$

2. (4pts) Convert to scientific notation or a decimal number:

$$7.7369 \times 10^{-4} = 0.00077369$$

$$100,873,200 = 1.008732 \times 10^8$$

3. (8pts) Simplify and write in standard form:

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

$$\begin{aligned} \text{b) } (x^2-7)(2x^2-3x+4) &= 2x^4 - 3x^3 + 4x^2 - 14x^2 + 21x - 28 \\ &= 2x^4 - 3x^3 - 10x^2 + 21x - 28 \end{aligned}$$

4. (15pts) Use formulas to expand:

$$\text{a) } (2x^2 + 3)^2 = (2x^2)^2 + 2 \cdot 2x^2 \cdot 3 + 3^2 = 4x^4 + 12x^2 + 9$$

$$\text{b) } (3x - 5y)(3x + 5y) = (3x)^2 - (5y)^2 = 9x^2 - 25y^2$$

$$\begin{aligned} \text{c) } (4x - 1)^3 &= (4x)^3 - 3 \cdot (4x)^2 \cdot 1 + 3 \cdot 4x \cdot 1^2 - 1 \\ &= 64x^3 - 48x^2 + 12x - 1 \end{aligned}$$

5. (15pts) Factor the following. Use either a known formula or a factoring method.

$$\text{a) } x^2 - 7x - 18 = (x-9)(x+2)$$

$$\begin{array}{l} \text{prod} = -18 \quad -9, 2 \\ \text{sum} = -7 \end{array}$$

$$\text{b) } 8x^2 - 14x - 15 = 8x^2 - 20x + 6x - 15 = 4x(2x-5) + 3(2x-5)$$

$$\begin{array}{l|l|l} \text{prod} = -120 & -12, 10 & -20, 6 \\ \text{sum} = -14 & -2 & -14 \end{array} \quad = (4x+3)(2x-5)$$

$$\begin{aligned} \text{c) } 8u^3 - v^3 &= (2u)^3 - v^3 = (2u-v)((2u)^2 + 2u \cdot v + v^2) \\ &= (2u-v)(4u^2 + 2uv + v^2) \end{aligned}$$

6. (6pts) Verify the formula $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$ by multiplying out the left side and simplifying.

$$\begin{aligned} (a-b)^3 &= (a-b)^2(a-b) = (a^2 - 2ab + b^2)(a-b) \\ &= a^3 - a^2b - 2a^2b + 2ab^2 + b^2a - b^3 \\ &= a^3 - 3a^2b + 3ab^2 - b^3 \end{aligned}$$