

Simplify and write the answer so all exponents are positive:

$$\begin{aligned}
 1. \text{ (5pts)} \quad (2x^{-5}y^{-2})^2(3x^{-2}y^2)^4 &= 2^2(x^{-5})^2(y^{-2})^2 \cdot 3^4(x^{-2})^4(y^2)^4 \\
 &= 4x^{-10}y^{-4} \cdot 81x^{-8}y^8 \\
 &= 324x^{-18}y^4 = \frac{324y^4}{x^{18}}
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ (7pts)} \quad \frac{(6a^{-5}b^3)^2}{(4a^3b^{-2})^3} &= \frac{6^2(a^{-5})^2(b^3)^2}{4^3(a^3)^3(b^{-2})^3} = \frac{\overset{9}{\cancel{36}} a^{-10} b^6}{\underset{16}{\cancel{64}} a^9 b^{-6}} = \frac{9a^{-10-9} b^{6-(-6)}}{16} \\
 &= \frac{9a^{-19} b^{12}}{16} = \frac{9b^{12}}{16a^{19}}
 \end{aligned}$$

3. (4pts) Convert to scientific notation or a decimal number:

$$4.72391 \times 10^4 = \underline{47,239.1}$$

$$\underline{0.000000029571} = 2.9571 \times 10^{-8}$$

Simplify and write in standard form:

$$\begin{aligned}
 4. \text{ (4pts)} \quad 2x(x^3+1) - (3x-2)(x-2) &= 2x^4 + 2x - \overset{-8x}{(3x^2 - 2x - 6x + 4)} \\
 &= 2x^4 - 3x^2 + 10x - 4
 \end{aligned}$$

$$\begin{aligned}
 5. \text{ (4pts)} \quad (3x^2-x)(5x^2+3x-4) &= \underline{15x^4} + \underline{9x^3} - \underline{12x^2} - \underline{5x^3} - \underline{3x^2} + 4x \\
 &= 15x^4 + 4x^3 - 15x^2 + 4x
 \end{aligned}$$

Use formulas to expand:

6. (4pts) $(7u - 2v)(7u + 2v) = (7u)^2 - (2v)^2 = 49u^2 - 4v^2$

7. (5pts) $(3x^2 + 5y^3)^2 = (3x^2)^2 + 2 \cdot 3x^2 \cdot 5y^3 + (5y^3)^2$
 $= 9x^4 + 30x^2y^3 + 25y^6$

8. (6pts) $(3x - 2)^3 = (3x)^3 - 3 \cdot (3x)^2 \cdot 2 + 3 \cdot (3x) \cdot 2^2 - 2^3$
 $= 27x^3 - 54x^2 + 36x - 8$

Factor the following. Use either a known formula or a factoring method.

9. (3pts) $x^2 + 3x - 40 = (x+8)(x-5)$
prod = -40 8, -5
sum = 3

10. (6pts) $6x^2 + 11x - 7 = 6x^2 + 14x - 3x - 7 = 2x(3x+7) - (3x+7)$
prod = -42 14, -3
sum = 11
 $= (2x-1)(3x+7)$

11. (6pts) $64u^3 - 125 = (4u)^3 - 5^3$
difference
of cubes
 $= (4u-5)(4u^2 + 4u \cdot 5 + 5^2)$
 $= (4u-5)(16u^2 + 20u + 25)$

12. (6pts) The total gross domestic product for Kentucky in 2014 was estimated to be 188,602 million dollars. Kentucky's population for 2014 was estimated at 4,413,500. Calculate the total gross domestic product per person for Kentucky (dollars per person), and write it in scientific notation, rounded to six decimal points.

gross domestic product
per person $= \frac{188,602 \times 10^6}{4,413,500} = 42,732.97836$
 $= 4.273298 \times 10^4$ \$/person