

Directions: Show all work. No credit for answers without work.

1. [2 points] Simplify the following expressions if possible.

(a) $(x^2 + x^2)^3$

$$= (2x^2)^3 = 2^3 \cdot (x^2)^3 = 8 \cdot x^6 = \boxed{8x^6}$$

(b) $\sqrt{x^2 + y^2}$

No simplification possible.

~~Note~~ Note: $\sqrt{x^2 + y^2}$ is not equal to $\sqrt{x^2} + \sqrt{y^2}$.

2. [2 points] Let a , b , c , and d be integers. Express the sum $\frac{a}{b} + \frac{c}{d}$ as a single fraction.

$$= \frac{ad}{bd} + \frac{cb}{bd} = \boxed{\frac{ad + cb}{bd}}$$

3. [2 points] Suppose that the following are true:

- Every northern town is covered in snow.
- Every western town has a sheriff.
- If a town does not have a sheriff, then it is lawless.
- Raystone Point is clear of snow.
- Eight Springs has a sheriff.

Decide whether each of the following statements is true, false, or undecidable from the given facts; circle one option. (For this problem, you do not need to show your work.)

- (a) Raystone Point is a northern town.

True False Undecidable

- (b) Eight Springs is a not a lawless town.

True False Undecidable

- (c) Eight Springs is a western town.

True False Undecidable

- (d) Raystone Point has a sheriff or it is lawless (or both).

True False Undecidable

4. [2 points] Initially, a class has 100 students. After 20 men and 20 women add the class, the ratio of men to women is 2 to 3. How many men were in the class initially? How many women were in the class initially?

Let $m = \# \text{ men initially}$

Let $w = \# \text{ women initially.}$

$$\frac{20+m}{20+w} = \frac{2}{3}$$

$$m+w = 100$$

$$w = 100 - m$$

$$3(20+m) = 2(20+w)$$

$$60 + 3m = 40 + 2w$$

$$20 + 3m = 2(100 - m)$$

$$20 + 3m = 200 - 2m$$

$$5m = 180$$

$$m = 36, w = 64$$

5. [2 points] Find the derivatives of the following functions.

(a) $f(x) = x^3 + \sqrt{x} = x^3 + x^{\frac{1}{2}}$

$$f'(x) = 3x^2 + \frac{1}{2}x^{-\frac{1}{2}} = 3x^2 + \frac{1}{2\sqrt{x}}$$

(b) $f(x) = \sin(\cos(x)).$

$$f'(x) = \cos(\cos(x)) \cdot \frac{d}{dx} [\cos(x)]$$

$$= -\sin(x) \cos(\cos(x))$$