

1. Simplify each of the following.

$$\text{a) } \frac{\frac{1}{2} + \frac{1}{5} \cdot 3}{\frac{1}{2} - \frac{1}{5} \cdot 3} \quad \text{b) } -\frac{2}{5} + \frac{1}{4} \left(-\frac{3}{2}\right)^2$$

2. Simplify each of the following.

$$\text{a) } x^5 \cdot x^7 \quad \text{b) } (-x)^4 (-x)^7 \quad \text{c) } -a^4 (-a)^6 \quad \text{d) } \frac{2a^3 (-2ab)^3 (-ab^5)^2}{4b^5 (-2a^3b)^2}$$

3. Compute the greatest common factor and least common multiple of 42 and 120.

4. Compute the least common multiple of the smallest three prime numbers.

5. Suppose that  $x$  and  $y$  are natural numbers so that their greatest common factor is 6 and their least common multiple is 120. Find  $x$  and  $y$ . Is there just one pair of numbers possible?

6. Compute the area of the right triangle determined by the points  $A(-2, 1)$ ,  $B(7, 1)$ , and  $C(7, -5)$ .

7. Label each of the following statements as true or false.

- a)  $\sqrt{2}$  is a real number.
- b)  $\sqrt{18} - \sqrt{50} = -\sqrt{8}$
- c) If  $n$  and  $m$  are both divisible by 3, then so is  $n - m$ .
- d) Every rational number can be represented as a terminating decimal.
- e) If a number  $n$  is divisible by 3, then  $n^2$  is divisible by 9.

8. Prove that each of the following decimals represent rational numbers by converting them into a fraction of two integers. You do not need to reduce the fraction.

$$\text{a) } 2.315 \quad \text{b) } 2.31\bar{5} \quad \text{c) } 2.3\bar{15} \quad \text{d) } 2.\bar{315}$$

9. Simplify each of the following.

$$\text{a) } (2x + 3) + (5x - 1) \quad \text{b) } (2x + 3) - (5x - 1) \quad \text{c) } -2(2x + 3) - 8(5x - 1) \quad \text{d) } (2x + 3)(5x - 1)$$

10. Solve each of the following equations. Make sure to check your solutions.

$$\begin{array}{ll} \text{a) } 2x - 5(x - 3) = (x + 1)^2 - (x - 2)^2 & \text{f) } x(x - 2) = 2x + 5 \\ \text{b) } \frac{2}{3}x + \frac{3}{4} = \frac{4}{5} & \text{g) } x^2 = 36 \\ \text{c) } \frac{3x - 1}{5} - \frac{2x + 1}{3} = x - 8 & \text{h) } x^5 = 36x^4 \\ \text{d) } x(x + 1)(3x - 7)(x + 5)^2 = 0 & \text{i) } x^5 = 36x^3 \\ \text{e) } x^2 - 6x - 27 = 0 & \text{j*) } x^5 = 36x \end{array}$$

11. Completely factor each of the following.

$$\begin{array}{lll} \text{a) } 3x^2 - 48 & \text{d) } 100 - x^2 & \text{g) } x^4 - 1 \\ \text{b) } A^{10} - 9 & \text{e) } x^2 + 6x & \text{h) } (5a + 3b)^2 - (3a - b)^2 \\ \text{c) } -2x^2 - 50 & \text{f) } x^2 - 1 & \text{i) } (3x^2 - x + 5)^2 - (3x^2 + x - 5)^2 \end{array}$$

12. Completely factor each of the following **by completing the square**. Other methods will not be accepted for credit.

a)  $2x + x^2 - 48$       b)  $x^2 - 10x + 26$       c)  $2x^2 + 12x - 432$       d)  $-x^2 + 6x - 9$

13. Expand or simplify each of the following.

a)  $(x - 3)(2x + 1)$       e)  $(x + 2)(x - 2)$       i)  $\frac{\sqrt{48}}{\sqrt{3}}$   
b)  $(\sqrt{2} - 3)(2\sqrt{2} + 1)$       f)  $(\sqrt{5} + 2)(\sqrt{5} - 2)$       j)  $(\sqrt{2})^6$   
c)  $(2x - 5)^2$       g)  $3\sqrt{20} - \sqrt{45} + \sqrt{80}$   
d)  $(2\sqrt{3} - 5)^2$       h)  $\frac{10 - \sqrt{24}}{2}$

14. Compute the exact value of the expression  $-x^2 + 4x + 7$  if

a)  $x = \sqrt{2}$       b)  $x = \sqrt{5} - 1$       c)  $x = 2\sqrt{3} - 1$       d)  $x = 2 - \sqrt{11}$

15. Expand each of the following.

a)  $(a - b)(a + b)$       b)  $(a - b)(a^2 + ab + b^2)$       c)  $(a - b)(a^3 + a^2b + ab^2 + b^3)$

16. The price of a book was increased by 20%. The new price is \$96. What was the original price?

17. The price of this dress was reduced first by 10% and then by an additional 20%. What percent of a decrease is this if we want to express it as a single change?

## Answers

1. a)  $-11$       b)  $\frac{13}{80}$
2. a)  $x^{12}$       b)  $-x^{11}$       c)  $-a^{10}$       d)  $-a^2b^6$
3. 6 and 840
4. 30
5. 24 and 30 is possible, and also 6 and 120
6. 27 unit<sup>2</sup>
7. a) true    b) true    c) true    d) false    e) true
8. a)  $\frac{2315}{1000}$     b)  $\frac{2084}{900}$     c)  $\frac{2292}{990}$     d)  $\frac{2313}{999}$
9. a)  $7x + 2$     b)  $-3x + 4$     c)  $-44x + 2$     d)  $10x^2 + 13x - 3$
10. a) 2    b)  $\frac{3}{40}$     c) 7    d)  $0, -1, -5, \frac{7}{3}$     e)  $-3, 9$     f)  $-1, 5$     g)  $-6, 6$     h)  $0, 36$   
i)  $-6, 0, 6$     j\*)  $0, -\sqrt{6}, \sqrt{6}$
11. a)  $3(x + 4)(x - 4)$     b)  $(A^5 + 3)(A^5 - 3)$     c)  $-2(x^2 + 25)$     d)  $-(x + 10)(x - 10)$     e)  $x(x + 6)$   
f)  $(x + 1)(x - 1)$     g)  $(x^2 + 1)(x + 1)(x - 1)$     h)  $4(a + 2b)(4a + b)$     i)  $-12x^2(x - 5)$
12. a)  $(x + 8)(x - 6)$     b)  $x^2 - 10x + 26$     c)  $2(x + 18)(x - 12)$     d)  $-(x - 3)^2$
13. a)  $2x^2 - 5x - 3$     b)  $1 - 5\sqrt{2}$     c)  $4x^2 - 20x + 25$     d)  $37 - 20\sqrt{3}$     e)  $x^2 - 4$   
f) 1    g)  $7\sqrt{5}$     h)  $5 - \sqrt{6}$     i) 4    j) 8
14. a)  $5 + 4\sqrt{2}$     b)  $-3 + 6\sqrt{5}$     c)  $-10 + 12\sqrt{3}$     d) 0
15. a)  $a^2 - b^2$     b)  $a^3 - b^3$     c)  $a^4 - b^4$
16. \$80
17. 28% decrease