1. Let $a, b,$ and c be real numbers such that $a > 0, b < 0,$ and $c < 0$. Find the sign of each expression.
   a) $-b$ b) bc c) $a - b$
   d) $c - a$ e) $-abc$ f) bc^2

2. Prove that the following numbers are rational.
   a) $0.12\overline{35}$ b) $0.8\overline{36}$

3. a) Explain why the sum, the difference, and the product of two rational numbers are rational.

   b) Is the product of two irrational numbers necessarily irrational? What about the sum?

4. Is $\frac{1}{2} + \sqrt{2}$ rational or irrational? Is $\frac{1}{2} \cdot \sqrt{2}$ rational or irrational? In general, what can you say about the sum of a rational and an irrational number? What about the product?
5. Use set-builder notation to represent the set $\{6, 8, 10, \dots, 20\}$.
6. Is the set $\{x | \ x$ is a decimal between 0 and 1$\}$ finite or infinite?
7. *True or False:* The set of negative integers and the set of whole numbers are disjoint sets.
8. *True or False:* 9 is an element of $\{999\}$.
9. *True or False:*
   a) $1 \in \{6,2,5,1\}$ b) $7 \notin \{1,3,5,7\}$ c) $\{8,11,4\} = \{8,11,4,0\}$ d) $\{0\} = \emptyset$
10. *True or False:* For all sets A and B, $A \cap B \subseteq A \cup B$.

11. Knowing that $A = \{x | \ x \geq -2\}$, $B = \{x | \ x < 4\}$, $C = \{x | -1 < x \leq 5\}$, find

    a) $B \cup C$ b) $B \cap C$

    c) $A \cap C$ d) $A \cap B$

    e) $A \cap B \cap C$ f) $(A \cap B) \cup C$

12. Graph the set and simplify if possible.
    a) $(-2,0) \cup (-1,1)$ b) $(-2,0) \cap (-1,1)$

    c) $[-4,6] \cap [0,8)$ d) $[-4,6] \cup [0,8)$

    e) $(-\infty,-4) \cup (4,\infty)$ f) $(-\infty,6] \cap (2,10)$

13. *True or False?* If false, explain why.

    a) $|6 - 8| = |6| - |8|$ b) $|(-3)^3| = -|3^3|$

    c) $|-5| \cdot |6| = |-5 \cdot 6|$ d) $\frac{|-14|}{|2|} = \left|\frac{-14}{2}\right|$

    e) $|a - b| = |a| - |b|$, if $b > a > 0$ f) If a is negative, then $|a| = -a$.

14. Replace $\square$ with = or $\neq$ to make the statement true for all real a, b, c, d, whenever the expression is defined.

a) $\frac{ab+ac}{a} \square\ b + ac$ b) $\frac{ab+ac}{a} \square\ b + c$

c) $\frac{b+c}{a} \square\ \frac{b}{a} + \frac{c}{a}$ d) $\frac{a+c}{b+d} \square\ \frac{a}{b} + \frac{c}{d}$

e) $(a \div b) \div c \square\ a \div (b \div c)$ f) $(a - b) - c \square\ a - (b - c)$

g) $\frac{a-b}{b-a} \square\ -1$ h) $-(a + b) \square\ -a + b$

15. Determine what signs on x and y values would make the statement true. Assume that x and y are not 0.

a) $xy > 0$ b) $x^2y > 0$ c) $\frac{x}{y} < 0$

16. Rewrite each statement using inequalities.

a) x is positive
b) x and y have the same sign
c) t is less that 4
d) z is at least 1
e) a is positive and is less than or equal to π
f) b is at most 8
g) the distance from x to y is equal to 5
h) a is between x and y
i) the distance from p to 3 is at most 5
j) x is at least 2 units from π

17. Rewrite each expression without using the absolute value symbol.

a) $|3 + x|\ \ if\ \ x < -3$ b) $|5 - x|\ \ if\ \ x > 5$

c) $|2 - x|\ \ if\ \ x < 2$ d) $|7 + x|\ \ if\ \ x \geq -7$

e) $|a - b|\ \ if\ \ a < b$ f) $|a - b|\ \ if\ \ a > b$

g) $|x^2 + 4|$ h) $|-x^2 - 1|$

18. Evaluate these expressions in your mind. Use the Laws of Exponents to make the calculations easier.

a) $\frac{18^5}{9^5}$ b) $20^6 \cdot (0.5)^6$

19. Which pair of numbers is closer together?

a) 10^{10} and 10^{50} b) 10^{100} and 10^{101}

20. Simplify. Leave the answer with only positive exponents.

a) $\left(\frac{q^{-1}rs^{-2}}{r^{-5}sq^{-8}}\right)^{-1}$ b) $(3ab^2c)\left(\frac{2a^2b}{c^3}\right)^{-2}$

21. Evaluate.

a) $\left(\frac{1}{32}\right)^{2/5}$ b) $27^{-4/3}$ c) $\left(\frac{1}{8}\right)^{-2/3}$

22. Simplify.

a) $\sqrt[3]{\sqrt{64x^6}}$ b) $\sqrt[3]{a^2b}\sqrt[3]{a^4b}$

b) $\sqrt[4]{81x^6y^3} - \sqrt[4]{16x^{10}y^3}$

23. Rationalize denominators.

a) $\frac{1}{\sqrt[3]{4}}$ b) $\frac{1}{3\sqrt[4]{3}}$

c) $\frac{p-4}{\sqrt{p}+2}$ d) $\frac{2\sqrt{x}}{2\sqrt{x}-\sqrt{y}}$

24. Rationalize the numerator.

a) $\frac{\sqrt{a}-\sqrt{b}}{a^2-b^2}$ b) $\frac{\sqrt{x}-\sqrt{x+h}}{h\sqrt{x}\sqrt{x+h}}$