

MATH 1021-04: Precalculus - Algebra

Sections 1.1 & 1.2 Handout

Warm-up:

Please try the following exercises:

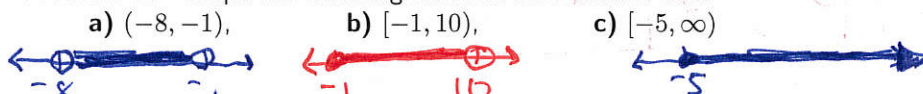
a) Expand: $6(t+4) = 6t + 24$ (Distribute!)

b) Evaluate the expression shown in **Problem 3** below.

Section 1.1 - The Real Numbers:

The Number Line and Absolute Value:

Problem 1. Graph the following intervals on a number line:



Problem 2. Fill in the blank with one of $<$, $>$, or $=$:

a) $|5| < |-6|$,

b) $|3| \cdot |-5| = |3(-5)|$,

c) $|6 - (-4)| = |-4 - 6|$
 $|10| = |-10|$

Order of Operations & Parentheses: Evaluate the following expressions:

Problem 3. $9 - 3 \times 4 - (-2) * (3 - 5) + 2 * 6 \div 3 = -3$

Problem 4. $3(2 + 4(6 + 1)) = 3(2 + 4(7)) = 3(2 + 28) = 3(30) = 90$

Problem 5. $\frac{[4 - (1 + 2(6 - 3)^2)]^2}{2 - 3} = \frac{[4 - (1 + 2(3)^2)]^2}{-1} = \frac{[4 - 19]^2}{-1} = \frac{[-15]^2}{-1} = -225$

Properties of Fractions: Evaluate the following expressions:

Problem 6. $\frac{5}{3} + \frac{2}{5} \cdot \frac{3}{3} = \frac{5}{3} + \frac{2}{5} = \frac{11}{15}$

Problem 7. $\frac{d}{a} \cdot \frac{a}{b} - \frac{c}{d} \cdot \frac{b}{b} = \frac{ad - bc}{bd}$

Problem 8. $24 \div \frac{2}{3} = 24 * \frac{3}{2} = 12 * 3 = 36$

Section 1.2 - Exponents and Radicals:

Definition & Properties of Exponents: Evaluate the following Expressions:

Problem 9. $(-2)^4 = 16$, $-(2)^4 = -16$

Problem 10. $3(-2)^5 = -96$, $(3 \cdot (-2))^5 = -7776$
 $3(-32) = -96$, $(-6)^5 = -7776$

Write as an expression with a single exponent:

Problem 11. $2^5 \cdot 2^2 = 2^{5+2} = 2^7$

Problem 12. $(3^2)^6 = 3^{2 \cdot 6} = 3^{12}$

Problem 13. $(9^{50} \cdot 9^2)^{10} = (9^{52})^{10} = 9^{520}$

Radicals: Evaluate the following Expressions:

Problem 14. $\sqrt{64} = \sqrt{8^2} = 8$

Problem 15. $\sqrt[3]{-64} = \sqrt[3]{(-4)^3} = -4$

Problem 16. $\sqrt[5]{-32} = \sqrt[5]{(-2)^5} = -2$

Problem 17. $\left(-\frac{27}{8}\right)^{2/3} = \left(-\frac{27^{1/3}}{8^{1/3}}\right)^2 = \left(-\frac{3}{2}\right)^2 = \frac{9}{4}$

Work the Problems on the Laws of Exponents Handout (next page →)

Laws of Exponents:

$$a^0 = 1, \quad a^{-n} = \frac{1}{a^n}$$

$$\textcircled{1} \quad a^m a^n = a^{m+n}$$

← to multiply powers of like bases, add exponents

$$\textcircled{2} \quad \frac{a^m}{a^n} = a^{m-n}$$

← to divide powers of like bases, subtract

$$\textcircled{3} \quad (a^m)^n = a^{mn}$$

← to raise a power to a power, multiply

$$\textcircled{4} \quad (ab)^n = a^n b^n$$

← raise each factor to the power

$$\textcircled{5} \quad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

← raise top and bottom to power

$$\textcircled{6} \quad \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$$

← to raise a number to a negative power, invert and change the sign of the power

$$\textcircled{7} \quad \frac{a^{-n}}{b^{-m}} = \frac{b^m}{a^n}$$

Properties of n^{th} roots:

$$\textcircled{1} \quad \sqrt[n]{ab} = \sqrt[n]{a} \sqrt[n]{b}$$

$$\textcircled{2} \quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$$

$$\textcircled{3} \quad \sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$$

$$\textcircled{4} \quad \sqrt[n]{a^n} = a \text{ if } n \text{ is odd}$$

$$\textcircled{5} \quad \sqrt[n]{a^n} = |a| \text{ if } n \text{ is even}$$

Simplify Each Expression

$$\text{a) } x^8 x^2 = x^{8+2} = \boxed{x^{10}}$$

$$\text{b) } x^2 x^{-6} = x^{2-6} = x^{-4} = \boxed{\frac{1}{x^4}}$$

$$\text{c) } \left(\frac{x^4 z^2}{4 y^5}\right) \left(\frac{2 x^3 y^2}{z^3}\right)^2 = \left(\frac{x^4 z^2}{4 y^5}\right) \left(\frac{4 x^6 y^4}{z^6}\right)$$

$$\begin{aligned} &= \frac{4}{4} x^{4+6} y^{4-5} z^{2-6} \\ &= x^{10} y^{-1} z^{-4} \\ &= \boxed{\frac{x^{10}}{y z^4}} \end{aligned}$$

$$\text{d) } \left(\frac{y}{5 x^{-2}}\right)^{-3} = \frac{y^{-3}}{5^{-3} x^6}$$

$$\text{e) } \frac{5^{3/2}}{5^{1/2}}$$

$$= 5^{3/2 - 1/2} = 5^{2/2} = \boxed{5}$$