College Algebra Notes

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1   A Bit of Review

Concepts:

- Order of Operations

- Square roots and principal square roots.

- Negation.

(Section 1.1)

1.1   Order of Operations

In an expression without parentheses, exponents are performed first. Then multiplication and division are performed (from left to right). Addition and subtraction are performed last (from left to right).

Example 1.1
Simplify the expression $-3^2 + 1$.

$$-3^2 + 1 = -1 \cdot 3^2 + 1 = -1 \cdot 9 + 1 = -9 + 1 = -8$$

If an expression contains parentheses,

- Do all computations inside the parentheses before doing any computations outside the parentheses.

- When dealing with parentheses within parentheses, begin with the innermost pair and work outward.

Example 1.2
List the order in which operations are being applied to x.

$$2(x^3 - 5) + 1$$

1. cube

2. subtract 5

3. multiply by 2

4. add 1

Example 1.3
List the order in which operations are being applied to a.

$$b^3 - 2a$$

1. multiply by -2

2. add b^3

1.2   Square Roots and Principal Square Roots

Definition 1.4

If $x^2 = y$, then x is **a square root of** y.
If $x^2 = y$ and x is **non-negative**, then x is **the principal square root of** y and we write $x = \sqrt{y}$.

Example 1.5 (Square Roots)
All of the following are true.

(a) 3 is a square root of 9.

(b) -3 is a square root of 9.

(c) 3 is the principal square root of 9.

(d) $\sqrt{9} = 3$

Example 1.6 (Do you understand square roots?)
What is $\sqrt{4}$?

(a) 2

(b) -2

(c) Both 2 and -2

(d) 16

(e) -16

(f) Both 16 and -16

> **Property 1.7**
>
> $$\sqrt{ab} = \sqrt{a}\sqrt{b}$$

Example 1.8 (Can you simplify square roots?)
Simplify.

1. $\sqrt{720}\sqrt{5} = \sqrt{750 \cdot 5} = \sqrt{3600} = \sqrt{36 \cdot 100} = \sqrt{36} \cdot \sqrt{100} = 6 \cdot 10 = 60$

2. $\sqrt{1792} + \sqrt{7} = \sqrt{256 \cdot 7} + \sqrt{7} = \sqrt{256} \cdot \sqrt{7} + \sqrt{7} = 16 \cdot \sqrt{7} + \sqrt{7} = 17\sqrt{7}$

1.3 Negation

If x is positive, then $-x$ is negative.

If x is negative, then $-x$ is positive.

The negative of $5-x$ is $x-5$. Note $-(5-x) = -5+x = x-5$

The negative of $x-y$ equals $y-x$. Note $-(x-y) = -x+y = y-x$

Example 1.9 (Do you understand negative numbers?)
Which of the following is positive?

(a) $\pi - 2$

   Note that $\pi \approx 3.14$ so $\pi - 2 \approx 1.14$ which is positive

(b) $\sqrt{7} - 3$

   Note that $\sqrt{7} < \sqrt{9} = 3$ so $\sqrt{7} - 3$ is negative

Example 1.10 (Do you understand negation?)
Find the **exact** value.

(a) $-(\pi - 2) = -(\pi - 2) = -\pi + 2 = 2 - \pi$

(b) $-(\sqrt{7} - 3) = -(\sqrt{7} - 3) = -\sqrt{7} + 3 = 3 - \sqrt{7}$