

# UNIT 4

## EXTENDING THE NUMBER SYSTEM

**Name:**

2nd Period Key

## Unit 4 Standards

### **Extend the properties of exponents to rational exponents.**

MGSE9-12.N.RN.2 Rewrite expressions involving radicals (i.e., simplify and/or use the operations of addition, subtraction, and multiplication, with radicals within expressions limited to square roots).

### **Use properties of rational and irrational numbers.**

MGSE9-12.N.RN.3 Explain why the sum or product of rational numbers is rational; why the sum of a rational number and an irrational number is irrational; and why the product of a nonzero rational number and an irrational number is irrational.

### **Perform arithmetic operations on polynomials**

MGSE9-12.A.APR.1 Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations.

## Learning Targets

1. I can simplify a radical expression.
2. I can perform operations on radicals.
3. I can identify rational and irrational numbers.
4. I can explain why the sum or product of rational numbers is rational.
5. I can explain why the sum of a rational number and irrational number is irrational.
6. I can explain why the product of a nonzero rational number and an irrational number is irrational.
7. I can add polynomials.
8. I can subtract polynomials.
9. I can multiply polynomials.
10. I can apply operations of polynomials to find the perimeter, area, and volume of geometric figures.

**Review of Simplifying Radicals:**

1.  $\sqrt{54}$   
 $\sqrt{2} \sqrt{27}$   
 $\sqrt{3} \sqrt{9}$   
 $\sqrt{3} \sqrt{3}$   
 $3\sqrt{2 \cdot 3}$   
 $3\sqrt{6}$

2.  $\sqrt{27}$   
 $\sqrt{3} \sqrt{9}$   
 $\sqrt{3} \sqrt{3}$   
 $3\sqrt{3}$

3.  $\sqrt{96}$   
 $\sqrt{2} \sqrt{48}$   
 $2 \sqrt{24}$   
 $\sqrt{2} \sqrt{12}$   
 $\sqrt{2} \sqrt{6}$   
 $\sqrt{2} \sqrt{3}$   
 $2 \cdot 2 \sqrt{2 \cdot 3}$   
 $4\sqrt{6}$

4.  $\sqrt{32}$   
 $\sqrt{2} \sqrt{16}$   
 $\sqrt{4} \sqrt{4}$   
 $4\sqrt{2}$

5.  $\frac{5}{\sqrt{3}} \frac{\sqrt{3}}{\sqrt{3}}$   
 $\frac{5\sqrt{3}}{3}$

6.  $\frac{3}{4\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}}$   
 $\frac{3\sqrt{2}}{4 \cdot 2}$   
 $\frac{3\sqrt{2}}{8}$

7.  $\frac{3}{\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}}$   
 $\frac{3\sqrt{2}}{2}$

8.  $\frac{5}{2\sqrt{3}} \frac{\sqrt{3}}{\sqrt{3}}$   
 $\frac{5\sqrt{3}}{2 \cdot 3}$   
 $\frac{5\sqrt{3}}{6}$

**Adding and Subtracting Radicals:**

9.  $3\sqrt{6} - 4\sqrt{6}$   
 $-1\sqrt{6}$   
 $-\sqrt{6}$

10.  $-3\sqrt{7} + 4\sqrt{7}$   
 $1\sqrt{7}$   
 $\sqrt{7}$

11.  $-11\sqrt{21} - 11\sqrt{21}$   
 $-22\sqrt{21}$

12.  $-9\sqrt{15} + 10\sqrt{15}$   
 $1\sqrt{15}$   
 $\sqrt{15}$

13.  $-10\sqrt{7} + 12\sqrt{7}$   
 $2\sqrt{7}$

14.  $-3\sqrt{17} - 4\sqrt{17}$   
 $-7\sqrt{17}$

15.  $-10\sqrt{11} - 11\sqrt{11}$   
 $-21\sqrt{11}$

16.  $3\sqrt{6} - 4\sqrt{6}$   
 $-1\sqrt{6}$   
 $-\sqrt{6}$

17.  $-3\sqrt{6} + 3\sqrt{6}$   
 $0\sqrt{6}$   
 $0$

$$18. 2\sqrt{6} + 3\sqrt{54}$$

$$2\sqrt{6} + 3(3\sqrt{6})$$

$$2\sqrt{6} + 9\sqrt{6}$$

$$\boxed{11\sqrt{6}}$$

$$\sqrt{54}$$

$$\sqrt{2} \sqrt{27}$$

$$\sqrt{3} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{6}$$

$$19. -2\sqrt{3} + 3\sqrt{27}$$

$$-2\sqrt{3} + 3(3\sqrt{3})$$

$$-2\sqrt{3} + 9\sqrt{3}$$

$$\boxed{7\sqrt{3}}$$

$$\sqrt{27}$$

$$\sqrt{3} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{3}$$

$$20. 2\sqrt{6} - 2\sqrt{24}$$

$$2\sqrt{6} - 2(2\sqrt{6})$$

$$2\sqrt{6} - 4\sqrt{6}$$

$$\boxed{-2\sqrt{6}}$$

$$\sqrt{24}$$

$$\sqrt{2} \sqrt{12}$$

$$\sqrt{2} \sqrt{6}$$

$$\sqrt{2} \sqrt{3}$$

$$2\sqrt{6}$$

$$21. -\sqrt{12} + 3\sqrt{3}$$

$$-2\sqrt{3} + 3\sqrt{3}$$

$$\boxed{\sqrt{3}}$$

$$\sqrt{12}$$

$$\sqrt{2} \sqrt{6}$$

$$\sqrt{2} \sqrt{3}$$

$$2\sqrt{3}$$

$$22. 3\sqrt{3} - \sqrt{27}$$

$$3\sqrt{3} - 3\sqrt{3}$$

$$\boxed{0}$$

$$\sqrt{27}$$

$$\sqrt{3} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{3}$$

$$23. 3\sqrt{8} + 3\sqrt{2}$$

$$3(2\sqrt{2}) + 3\sqrt{2}$$

$$6\sqrt{2} + 3\sqrt{2}$$

$$\boxed{9\sqrt{2}}$$

$$\sqrt{8}$$

$$\sqrt{2} \sqrt{4}$$

$$\sqrt{2} \sqrt{2}$$

$$2\sqrt{2}$$

$$24. -3\sqrt{20} - \sqrt{5}$$

$$-3(2\sqrt{5}) - \sqrt{5}$$

$$-6\sqrt{5} - \sqrt{5}$$

$$\boxed{-7\sqrt{5}}$$

$$\sqrt{20}$$

$$\sqrt{2} \sqrt{10}$$

$$\sqrt{2} \sqrt{5}$$

$$2\sqrt{5}$$

$$25. 2\sqrt{45} - 2\sqrt{5}$$

$$2(3\sqrt{5}) - 2\sqrt{5}$$

$$6\sqrt{5} - 2\sqrt{5}$$

$$\boxed{4\sqrt{5}}$$

$$\sqrt{45}$$

$$\sqrt{5} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{5}$$

$$26. 3\sqrt{18} - 2\sqrt{2}$$

$$3(3\sqrt{2}) - 2\sqrt{2}$$

$$9\sqrt{2} - 2\sqrt{2}$$

$$\boxed{7\sqrt{2}}$$

$$\sqrt{18}$$

$$\sqrt{2} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{2}$$

### Multiplying Radicals:

$$27. \sqrt{2} * \sqrt{5}$$

$$\sqrt{10}$$

$$\sqrt{2} \sqrt{5}$$

$$\sqrt{10}$$

$$28. \sqrt{6} * \sqrt{8}$$

$$\sqrt{48}$$

$$2 \cdot 2 \cdot \sqrt{3}$$

$$4\sqrt{3}$$

$$\sqrt{2} \sqrt{24}$$

$$\sqrt{2} \sqrt{12}$$

$$\sqrt{2} \sqrt{6}$$

$$\sqrt{2} \sqrt{3}$$

$$29. \sqrt{5} * \sqrt{12}$$

$$\sqrt{60}$$

$$\sqrt{2} \sqrt{30}$$

$$\sqrt{2} \sqrt{15}$$

$$\sqrt{3} \sqrt{5}$$

$$2\sqrt{3 \cdot 5} = 2\sqrt{15}$$

$$30. \sqrt{12} * \sqrt{8}$$

$$\sqrt{96}$$

$$\sqrt{2} \sqrt{48}$$

$$\sqrt{2} \sqrt{24}$$

$$\sqrt{2} \sqrt{12}$$

$$\sqrt{2} \sqrt{6}$$

$$\sqrt{2} \sqrt{3}$$

$$31. \sqrt{8} * \sqrt{4}$$

$$\sqrt{32}$$

$$\sqrt{2} \sqrt{16}$$

$$\sqrt{4} \sqrt{4}$$

$$4\sqrt{2}$$

$$32. \sqrt{5} * \sqrt{7}$$

$$\sqrt{35}$$

$$2 \cdot 2 \cdot \sqrt{2 \cdot 3}$$

$$4\sqrt{6}$$

## Rational and Irrational Numbers:

Rational Numbers: A number that can be expressed as a fraction, a whole #, or a decimal that either terminates or has a pattern.

EX. 5, -6, 0, 2.265, 3.141414...,  $\frac{2}{3}$ , etc.

Irrational Numbers: A number that cannot be expressed as a fraction. A decimal that does not terminate and does not have a pattern.

EX. 2.16154831...,  $\sqrt{2}$ ,  $\pi$ , etc.

Determine whether the following are Rational or Irrational:

- |                            |  |  |   |
|----------------------------|--|--|---|
| 1. 0.21<br>Rational        | 2. $\frac{3}{12}$<br>Rational                | 3. 8.33865267...<br>Irrational               | 4. 3.14141414...<br>Rational              |
| 5. 12.52<br>Rational       | 6. 0<br>Rational                             | 7. $\pi$<br>Irrational                       | 8. $\sqrt{19}$<br>Irrational              |
| 9. $\sqrt{64}$<br>Rational | 10. $\sqrt{2} - \sqrt{2}$<br>= 0<br>Rational | 11. $\frac{3}{12} + \frac{5}{2}$<br>Rational | 12. 777.7777...<br>Rational               |
| 13. -1<br>Rational         | 14. 1.25698712302...<br>Irrational           | 15. $\frac{\pi}{\pi} = 1$<br>Rational        | 16. -0.515<br>Rational                    |
| 17. 30<br>Rational         | 18. $-\frac{2}{3}$<br>Rational               | 19. $\sqrt{100} = 10$<br>Rational            | 20. $\sqrt{3} * \sqrt{3} = 3$<br>Rational |

Directions: Use these values to complete level 1 and level 2 below:

$$\begin{array}{ll} A = 0 & D = \sqrt{16} \\ B = \sqrt{5} & E = 16 \\ C = 10 & F = \sqrt{20} \end{array}$$

LEVEL 1: Identify whether each of the following are rational or irrational.

$$\begin{array}{ll} A: \underline{0 \quad \text{Rational}} & B: \underline{\sqrt{5} \quad \text{Irrational}} \\ C: \underline{10 \quad \text{Rational}} & D: \underline{\sqrt{16} = 4 \quad \text{Rational}} \\ E: \underline{16 \quad \text{Rational}} & F: \underline{\sqrt{20} \quad \text{Irrational}} \end{array}$$

LEVEL 2: Identify whether each of the following are rational or irrational.

$$\begin{array}{ll} D + E: \underline{\frac{\sqrt{16} + 16 = 20}{4 + 16} \quad \text{Rational}} & B \cdot C: \underline{\sqrt{5} \cdot 10 = 10\sqrt{5} \quad \text{Irrational}} \\ A + B: \underline{0 + \sqrt{5} = \sqrt{5} \quad \text{Irrational}} & B \cdot F: \underline{\sqrt{5} \cdot \sqrt{20} = \sqrt{100} = 10 \quad \text{Rational}} \\ C + E: \underline{10 + 16 = 26 \quad \text{Rational}} & C \cdot D: \underline{10 \cdot \sqrt{16} = 10 \cdot 4 = 40 \quad \text{Rational}} \\ B + F: \underline{\sqrt{5} + \sqrt{20} \quad \text{Irrational}} & A \cdot C: \underline{0 \cdot 10 = 0 \quad \text{Rational}} \end{array}$$

What happens when you...

Add a Rational Number and an Irrational Number? Irrational

Add a Rational Number and a Rational Number? Rational

Multiply a Rational Number by a Rational Number? Rational

Multiply an Irrational Number by a non-zero Rational Number? Irrational

Multiply an Irrational Number by an Irrational Number? Either

$$\begin{array}{ll} \text{ex. } \sqrt{2} \cdot \sqrt{3} & \textcircled{I} \\ \sqrt{2} \cdot \sqrt{2} & \textcircled{R} \end{array}$$

### Adding Polynomials

Ex. 1  $(\underline{5x-8}) + (\underline{7x+10})$

$$12x + 2$$

Ex. 2  $(\underline{-a^2+2a-8}) + (\underline{2a^2-9a+15})$

$$a^2 - 7a + 7$$

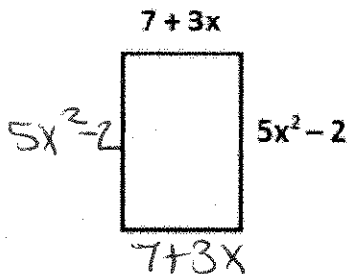
Ex. 3  $(\underline{5x^3-4x^2+6}) + (\underline{2x^3+2x^2-3x-1})$

$$7x^3 - 2x^2 - 3x + 5$$

Ex. 3 Find the sum of  $\underline{2x^2+8x+4}$  and  $\underline{x^2-8x-2}$

$$3x^2 + 2$$

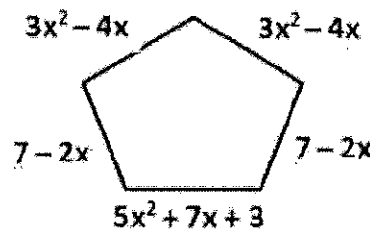
Ex. 5 Find the Perimeter of the following:



$$10x^2 + 6x + 10$$

units

Ex. 6 Find the Perimeter of the following:



$$11x^2 - 5x + 17$$

units

### Subtracting Polynomials:

Ex. 7  $(\underline{-6x-4}) - (\underline{2x+6})$

$$\underline{-6x-4} - \underline{2x+6}$$

$$-8x - 10$$

Ex. 8  $(\underline{-7m^3-m^2-m}) - (\underline{-10m^3-m-1})$

$$\underline{-7m^3-m^2-m} + \underline{10m^3+m+1}$$

$$3m^3 - m^2 + 1$$

Ex. 9  $(\underline{4m^2+9m}) - (\underline{2m^2+6})$

$$\underline{4m^2+9m} - \underline{2m^2-6}$$

$$2m^2 + 9m - 6$$

Ex. 10  $(\underline{3x^3-2x^2+x}) - (\underline{x^2+2x-3})$

$$\underline{3x^3-2x^2+x} - \underline{x^2+2x-3}$$

$$3x^3 - 3x^2 - x + 3$$

**Adding and Subtracting Polynomials Practice (put answers in standard form):**

1.  $(4x^2 + x + 6) + (7x - 10)$

$4x^2 + 8x - 4$

3.  $(8x + 5) - (3x - 6)$

$8x + 5 - 3x + 6$

$5x + 11$

5.  $(14 - 6x) + (8x - 5)$

$2x + 9$

7.  $(5x^2 + 2x + 1) + (4x^2 + 3x - 8)$

$9x^2 + 5x - 7$

9.  $(-x^2 + 5x - 12) + (2x^2 - 6)$

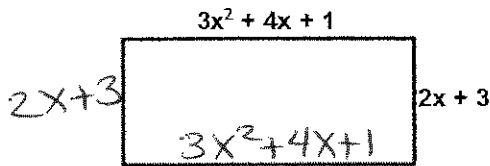
$x^2 + 5x - 18$

11.  $(5x^2 - 6x - 1) - (4x^2 - 2x + 1)$

$5x^2 - 6x - 1 - 4x^2 + 2x - 1$

$x^2 - 4x - 2$

13. Find the Perimeter:



$6x^2 + 12x + 8$   
units

2.  $(-8x^2 + x + 5) - (2x^2 - 3)$

$-8x^2 + x + 5 - 2x^2 + 3$

$-10x^2 + x + 8$

4.  $(14p^4 + 7p^2) + (8p^3 + 7p^2 - p)$

$14p^4 + 8p^3 + 14p^2 - p$

6.  $(3x^4 + 3x^2 - 3) - (6x^5 - 9x^3 + 2)$

$3x^4 + 3x^2 - 3 - 6x^5 + 9x^3 - 2$

$-6x^5 + 3x^4 + 9x^3 + 3x^2 - 5$

8.  $(14x - 6) + (8x - 5) + (x + 4) + (2x + 1)$

$25x - 6$

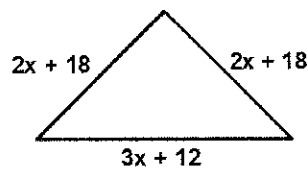
10.  $(2x^2 + 3x - 4) + (3x^2 - 4x + 9) + (-3x^2 + 3x + 7)$

$2x^2 + 2x + 12$

12.  $(9p^4 + 2p^2) + (2p^3 - 6p^2 - 7)$

$9p^4 + 2p^3 - 4p^2 - 7$

14. Find the Perimeter:



$7x + 48$   
units



**Multiplying Polynomials - Distribution:**

Ex. 1:  $5(2x + 5)$

$10x + 25$

Ex. 2:  $2x(4x + 6)$

$8x^2 + 12x$

Ex. 3:  $-4(2x^2 - 6x - 3)$

$-8x^2 + 24x + 12$

Ex. 4:  $3x(-x^2 + 8x - 2)$

$-3x^3 + 24x^2 - 6x$

**Multiplying Polynomials - FOIL and the Box Method:**

Ex. 5:  $(x + 2)(x + 3)$

FOIL (Distribution)

$(x+2)(x+3)$

$x^2 + 3x + 2x + 6$

$x^2 + 5x + 6$

Box Method

	$x$	$2$
$x$	$x^2$	$2x$
$3$	$3x$	$6$

$x^2 + 5x + 6$

Ex. 6:  $(x - 3)(x^2 + 3x + 2)$

FOIL (Distribution)

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

$x^3 + 3x^2 + 2x$   
 $-3x^2 - 9x - 6$

$x^3 - 7x - 6$

Box Method

	$x^2$	$3x$	$2$
$x$	$x^3$	$3x^2$	$2x$
$-3$	$-3x^2$	$-9x$	$-6$

$x^3 - 7x - 6$

Ex. 7  $(x^2-1)(x+3)$

$$x^3 + 3x^2 - x - 3$$

Ex. 9  $(x-7)^2$

$$(x-7)(x-7)$$

$$x^2 - 7x - 7x + 49$$

$$x^2 - 14x + 49$$

Ex. 8  $(x-4)(-x^2+7x-3)$

$$-x^3 + 7x^2 - 3x$$

$$4x^2 - 28x + 12$$


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$$-x^3 + 11x^2 - 31x + 12$$

Ex. 10  $(x-5)^3 (x-5)(x-5)(x-5)$

$(x-5)(x-5)$	$(x-5)(x^2-10x+25)$
$x^2-5x-5x+25$	$x^3-10x^2+25x$
$x^2-10x+25$	$-5x^2+50x-125$
	<hr/>
	$x^3-15x^2+75x-125$

**You Practice:**

1.  $(x+1)(x+1)$

$$x^2 + x + x + 1$$

$$x^2 + 2x + 1$$

2.  $7x(x-5)$

$$7x^2 - 35x$$

3.  $(x+2)(x+2)$

$$x^2 + 2x + 2x + 4$$

$$x^2 + 4x + 4$$

4.  $2x(x+6)$

$$2x^2 + 12x$$

5.  $(2x+1)(x+3)$

$$2x^2 + 6x + x + 3$$

$$2x^2 + 7x + 3$$

6.  $(2x+3)(-x+2)$

$$-2x^2 + 4x - 3x + 6$$

$$-2x^2 + x + 6$$

7.  $4x^2(x+2)$

$$4x^3 + 8x^2$$

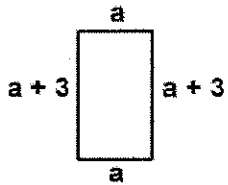
8.  $(4x+4)(5x-5)$

$$20x^2 - 20x + 20x - 20$$

$$20x^2 - 20$$

**Polynomial Multiplication with Application:**

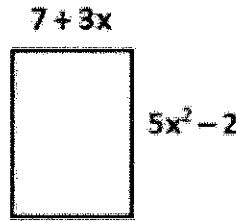
Ex. 1 Find the Area of the following:



$$a(a+3)$$

$$\underline{a^2 + 3a} \text{ units}^2$$

Ex. 2 Find the Area of the following:



$$(7+3x)(5x^2-2)$$

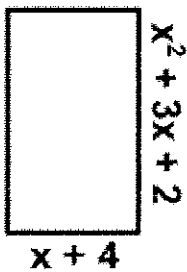
$$35x^2 - 14$$

$$+ 15x^3 - 6x$$

$$\underline{15x^3 + 35x^2 - 6x - 14}$$

$$\text{units}^2$$

Ex. 3 Find the Area of the following:



$$(x+4)(x^2+3x+2)$$

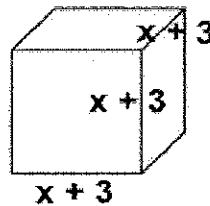
$$x^3 + 3x^2 + 2x$$

$$4x^2 + 12x + 8$$

$$\underline{x^3 + 7x^2 + 14x + 8}$$

$$\text{units}^2$$

Ex. 4 Find the Volume of the following:



Step 1

$$(x+3)(x+3)$$

$$x^2 + 3x + 3x + 9$$

$$x^2 + 6x + 9$$

Step 2

$$(x+3)(x^2 + 6x + 9)$$

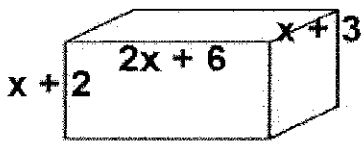
$$x^3 + 6x^2 + 9x$$

$$3x^2 + 18x + 27$$

$$\underline{x^3 + 9x^2 + 27x + 27}$$

$$\text{units}^3$$

Ex. 5 Find the Volume of the following:



$$(x+2)(2x+6)$$

$$2x^2 + 12x + 4x + 12$$

$$2x^2 + 16x + 12$$

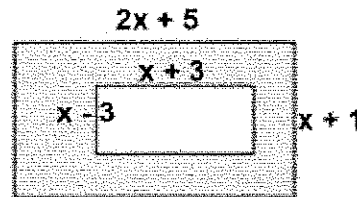
$$(x+3)(2x^2 + 16x + 12)$$

$$2x^3 + 16x^2 + 12x$$

$$6x^2 + 48x + 36$$

$$\underline{2x^3 + 22x^2 + 60x + 36} \text{ units}^3$$

Ex. 6 Find the Area of the shaded region:



Big  $\square$  - Little  $\square$

Big

$$(2x+5)(x+1)$$

$$2x^2 + 2x + 5x + 5$$

$$\underline{2x^2 + 7x + 5}$$

Little

$$(x-3)(x+3)$$

$$x^2 + 3x - 3x - 9$$

$$\underline{x^2 - 9}$$

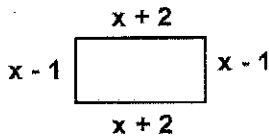
$$(2x^2 + 7x + 5) - (x^2 - 9)$$

$$2x^2 + 7x + 5 - x^2 + 9$$

$$\underline{x^2 + 7x + 14} \text{ units}^2$$

**You Practice:**

1. Find the Area of the following:



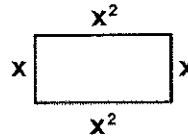
$$(x+2)(x-1)$$

$$x^2 - x + 2x - 2$$

$$\boxed{x^2 + x - 2}$$

units<sup>2</sup>

2. Find the Area of the following:

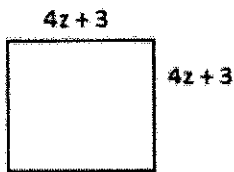


$$x(x^2)$$

$$\boxed{x^3}$$

units<sup>2</sup>

3. Find the Area of the following:



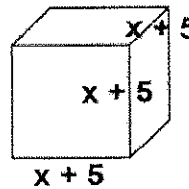
$$(4z+3)(4z+3)$$

$$16z^2 + 12z + 12z + 9$$

$$\boxed{16z^2 + 24z + 9}$$

units<sup>2</sup>

4. Find the Volume of the following:



$$(x+5)(x+5)$$

$$x^2 + 5x + 5x + 25$$

$$x^2 + 10x + 25$$

$$(x+5)(x^2 + 10x + 25)$$

$$x^3 + 10x^2 + 25x$$

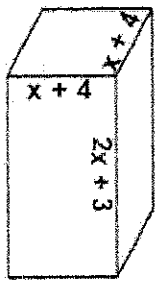
$$5x^2 + 50x + 125$$


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$$\boxed{x^3 + 15x^2 + 75x + 125}$$

units<sup>3</sup>

5. Find the Volume of the following:



$$(x+4)(x+4)$$

$$x^2 + 4x + 4x + 16$$

$$x^2 + 8x + 16$$

$$(2x+3)(x^2 + 8x + 16)$$

$$2x^3 + 16x^2 + 32x$$

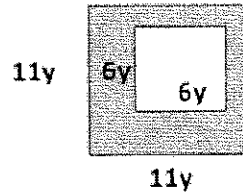
$$3x^2 + 24x + 48$$


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$$\boxed{2x^3 + 19x^2 + 56x + 48}$$

units<sup>3</sup>

6. Find the Area of the shaded region:



Big - Little

Big

$$11y(11y)$$

$$\boxed{121y^2}$$

Little

$$6y(6y)$$

$$\boxed{36y^2}$$

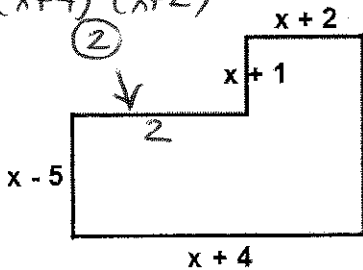
Big-Little

$$121y^2 - 36y^2 = \boxed{85y^2}$$

units<sup>2</sup>

**Challenge Question: Find the Perimeter.**

$$(x+4) - (x+2)$$



$$x+1 + x-5$$

$$\boxed{2x-4}$$

$$x+2$$

$$x+1$$

$$x-5$$

$$x+4$$

$$2$$

$$2x-4$$


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$$\boxed{6x}$$

units

# AG - Unit 4 REVIEW: Polynomials and Radicals

Name \_\_\_\_\_

Period \_\_\_\_\_ Date \_\_\_\_\_

Add, subtract, or multiply the following as indicated. Write your answer in standard form.

1.  $(2x+5) + (6x-2)$   
 $8x+3$

2.  $(10x+2) - (6x+5)$   
 $10x+2-6x-5$   
 $4x-3$

3.  $(4x^2-8x+1) + (3x^2-2x-8)$   
 $7x^2-10x-7$

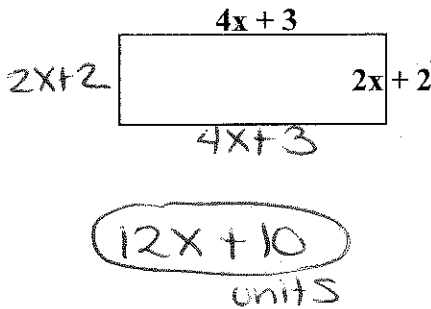
4.  $(x+4)(2x-8)$   
 $2x^2-8x+8x-32$   
 $2x^2-32$

5.  $(x+2)(x^2+5x+4)$   
 $x^3+5x^2+4x$   
 $2x^2+10x+8$   
 $x^3+7x^2+14x+8$

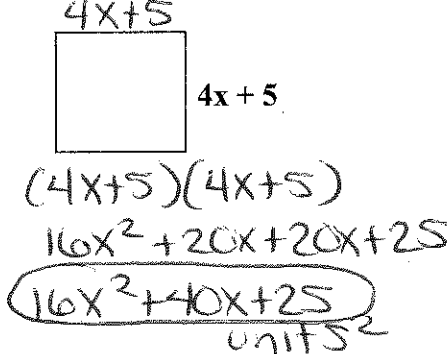
6.  $(7x^2+2x+1) - (-5x^2-6x-2)$   
 $7x^2+2x+1+5x^2+6x+2$   
 $12x^2+8x+3$

Find the Perimeter or Area of the following:

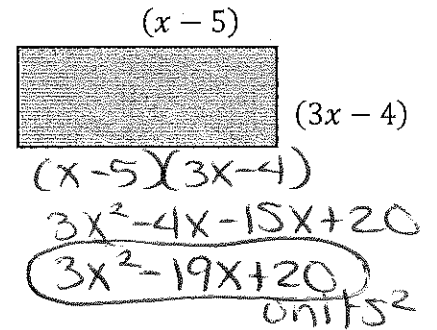
10. Find the Perimeter:



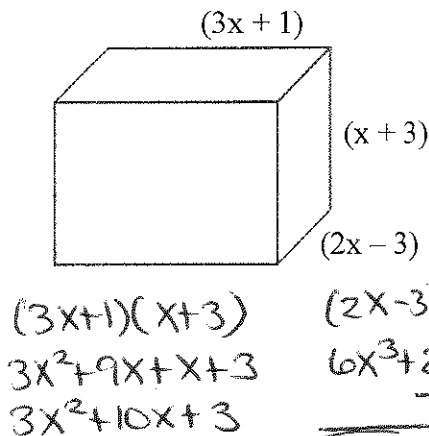
11. Find the Area:



12. Find the Area:



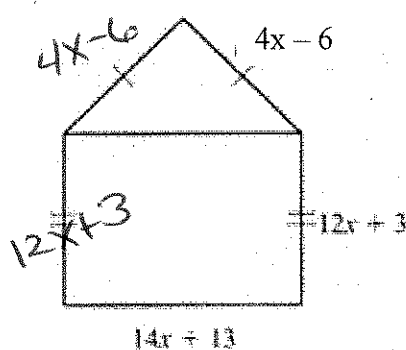
13. Find the volume (no parentheses in answer).



$(2x-3)(3x^2+10x+3)$   
 $6x^3+20x^2+6x$   
 $-9x^2-30x-9$   
 $6x^3+11x^2-24x-9$   
units<sup>3</sup>

14. A model of a house is shown.

What is the perimeter, in units, of the model?



$4x-6$   
 $4x-6$   
 $12x+3$   
 $12x+3$   
 $14x+13$   
 $46x+7$   
units

15. If  $2x^2 - 5x + 7$  is subtracted from  $4x^2 + 2x - 11$ , what is the coefficient of  $x$  in the result?

- (A) 2
- (B) 7
- (C) -3
- (D) -18

$$(4x^2 + 2x - 11) - (2x^2 - 5x + 7)$$

$$4x^2 + 2x - 11 - 2x^2 + 5x - 7$$

$$2x^2 + 7x - 18$$

↑

16. What is the resulting polynomial when  $3x + 7$  is multiplied by  $2x - 6$ ?

- (A)  $5x + 1$
- (B)  $6x - 42$
- (C)  $6x^2 - 4x - 42$
- (D)  $6x^2 + 9x - 42$

$$(3x + 7)(2x - 6)$$

$$6x^2 - 18x + 14x - 42$$

$$6x^2 - 4x - 42$$

17. Which of the following is an irrational number?

- (A) The sum of 3 and  $0.111\dots$  R
- (B) The product of  $2\sqrt{3}$  and width  $\frac{1}{\sqrt{3}}$  R
- (C) The product of  $\sqrt{16}$  and  $\sqrt{9}$  R
- (D) The sum of  $\sqrt{3}$  and  $0.\bar{3}$  I

18. Which of the following is not a rational number?

- (A) The product of 2 and  $0.\bar{3}$  R
- (B) The sum of  $2 + \sqrt{3}$  and  $5 - \sqrt{3}$  R
- (C) The sum of  $\frac{3}{7}$  and  $\frac{1}{2}$  R
- (D) The product of 2 and  $\sqrt{2}$  I

Will the end result be rational or irrational?

19. Irrational (Rational)

Irrational

20. Irrational + Irrational

Either

21. Irrational (Irrational)

Either

Simplify the following Radicals without a calculator. No decimals allowed.

22.  $\sqrt{8}$

$$\sqrt{2} \sqrt{4}$$

$$\sqrt{2} \sqrt{2}$$

$$2\sqrt{2}$$

23.  $\sqrt{45}$

$$\sqrt{3} \sqrt{15}$$

$$\sqrt{3} \sqrt{3} \sqrt{5}$$

$$3\sqrt{5}$$

24.  $\sqrt{72}$

$$\sqrt{2} \sqrt{36}$$

$$\sqrt{2} \sqrt{6} \sqrt{6}$$

$$6\sqrt{2}$$

25.  $\frac{15}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$

$$\frac{15\sqrt{5}}{5}$$

$$3\sqrt{5}$$

26.  $\frac{1}{3\sqrt{2}} \frac{\sqrt{2}}{\sqrt{2}}$

$$\frac{\sqrt{2}}{3 \cdot 2}$$

$$\frac{\sqrt{2}}{6}$$

27.  $-10\sqrt{7} - 17\sqrt{7}$

$$-27\sqrt{7}$$

28.  $-2\sqrt{3} + 5\sqrt{27}$

$$-2\sqrt{3} + 5(3\sqrt{3})$$

$$-2\sqrt{3} + 15\sqrt{3}$$

$$13\sqrt{3}$$

$\sqrt{27}$

$$\sqrt{3} \sqrt{9}$$

$$\sqrt{3} \sqrt{3}$$

$$3\sqrt{3}$$

29.  $\sqrt{12} \cdot \sqrt{4}$

$$2\sqrt{3} \cdot 2$$

$$4\sqrt{3}$$

$\sqrt{12}$

$$\sqrt{2} \sqrt{4} \sqrt{3}$$

$$2\sqrt{3}$$