Warm Up

- Solve for x
- 1. $x + 7 = 13$
- 2. $2x + 3 = x + 9$

9.4
Factoring and word problems

- Factor

1. $x^2 - 9x = -18$
2. $-64 = -x^2$
3. $x^2 + 4 = -5x$
4. $x^2 = -5x$

- Factor

1. $3x^2 - 18x = 21$
2. $x^2 = 11x - 28$
3. $x^2 + 15x = -56$
4. $6x^2 = 42x - 72$

- Factor

1. $10x^2 - 9x = -2$
2. $x^2 = 12x - 27$
3. $x^2 = 1$
4. $20x^2 = 13x - 2$

- Factor

1. $15x = -11 + x^2 + 5x$
2. $4x^2 + 4x + 1 = 4x + 2$
3. $x + 2 = 3x - x^2 + 5$
4. $x^2 + 21x - 49 = 21x$

- An object is launched at 19.6 meters per second (m/s) from a 58.8-meter tall platform. The equation for the object's height $s$ at time $t$ seconds after launch is $s(t) = -4.9t^2 + 19.6t + 58.8$, where $s$ is in meters. When does the object strike the ground?
- Explain your answer in context of the problem.

- The International Space Agency has finally landed a robotic explorer on an extra-solar planet. Some probes are extended from the lander's body to conduct various tests. To demonstrate the crushing weight of gravity on this planet, the lander's camera is aimed at a probe's ground-level ejection port, and the port launches a baseball directly upwards at 147 feet per second (ft/s), about the top speed of a professional pitcher. The force due to gravity on this planet is 98 $ft/s^2$. Assuming no winds and that the probe can scurry out of the way in time, how long will it take for the ball to smack back into the surface?
- Explain your answer in context of the problem.
- $s = -49t^2 + 147t$

- If a toy rocket is launched vertically upward from ground level with an initial velocity of 128 feet per second, then its height h after t seconds is given by the equation h(t)=$16t^2 - 128t$ (if air resistance is neglected). How long will it take for the rocket to return to the ground?
- **Change plus to minus**

- A diver is standing on a platform 24 ft. above the pool. He jumps form the platform with an initial upward velocity of 8 ft/s. Use the formula $h(t) = -16t^2 + vt + s$ , where h is his height above the water, t is the time, v is his starting upward velocity, and s is his starting height. How long will it take for him to hit the water?

- A ball is thrown upward from a height of 15 ft. with an initial upward velocity of 8 ft/s. Use the formula $h(t) = -16t^2 + vt + s$ to find how long it will take for the ball to hit the ground.

- One of the games at a carnival involves trying to ring a bell with a ball by hitting a lever that propels the ball into the air. The height of the ball is modeled by the equation $h(t) = -16t^2 + 39t$. If the bell is 25 ft. above the ground, will it be hit by the ball?

- A relief package is released from a helicopter at 1600 feet. The height of the package can be modeled by the equation $h(t) = -16t^2 + 1600$ , where h is the height of the package in feet and t is the time in seconds. The pilot wants to know how long it will take for the package to hit the ground.

- The height of a flare fired from the deck of a ship in distress can be modeled by $h(t) = -16t^2 + 104t + 56$, where h is the height of the flare above water and t is the time in seconds. Find the time it takes the flare to hit the water.

- The height of a rocket launched upward from a 160-foot cliff is modeled by $h(t) = -16t^2 + 48t + 160$, where h is the height in feet and t is the time in seconds. Find when the rocket lands.

- Robert threw a rock off a bridge into the river. The distance from the rock to the river is modeled by the equation $h(t) = -16t^2 - 16t + 60$ , where h is the height in feet and t is the time in seconds. Find how long it took the rock to hit the surface of the water.

- During a game of golf, Kayley hits her ball out of a sand trap. The height of the golf ball is modeled by the equation $h(t) = -16t^2 + 20t - 4$, where h is the height in feet and t is the time in seconds since the ball was hit. Find how long it takes Kayley's golf ball to hit the ground.

- The height of a rock thrown off a cliff can be modeled by the equation $h(t) = -16t^2 - 8t + 120$, where h is the height in feet and t is the time in seconds. How long does it take the rock to reach the ground?

- **An object is launched from ground level directly upward at 39.2 m/s. For how long is the object at or above a height of 34.3 meters?**

- $s(t) = -4.9t^2 + 39.2t$

 Name_____

# Naming Polynomials

Date_____ Period____

**Name each polynomial by degree and number of terms.**

1) $2p^4 + p^3$

2) $-10a$

3) $2x^2$

4) $-10k^2 + 7$

5) $-5n^4 + 10n - 10$

6) $-6a^4 + 10a^3$

7) $6n$

8) $1$

9) $-9n + 10$

10) $5a^2 - 6a$

11) $8p^5 - 5p^3 + 2p^2 - 7$

12) $-7n^7 + 7n^4$

13) $-8n^4 + 5n^3 - 2n^2 - 8n$

14) $9v^7 + 7v^6 + 4v^3 - 1$

15) $9x^2 + 3x$

16) $-6$

17) $-10k^4 + k^2 - k$

18) $8a + 1$

19) $9r^6 - 8$

20) $9n^5 - 8n^3$

21) $2n^5$

22) $-10x^5$

23) $4x - 9x^2 + 4x^3 - 5x^4$

24) $10 + 8x$

25) $-4 - 2a^2 + 8a$

26) $4b^6 + 5b^5 + b^4$

27) $-1$

28) $7n^5 + 10n^4 - 3n + 10n^7$

29) $4$

30) $4r^6 - 3r^2 - 8r^4$

Name_____

# Adding and Subtracting Polynomials

Date_____ Period____

**Simplify each expression.**

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

2) $(a^3 - 2a^2) - (3a^2 - 4a^3)$

3) $(4 + 2n^3) + (5n^3 + 2)$

4) $(4n - 3n^3) - (3n^3 + 4n)$

5) $(3a^2 + 1) - (4 + 2a^2)$

6) $(4r^3 + 3r^4) - (r^4 - 5r^3)$

7) $(5a + 4) - (5a + 3)$

8) $(3x^4 - 3x) - (3x - 3x^4)$

9) $(-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$

10) $(3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$

11) $(12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$

12) $(8n - 3n^4 + 10n^2) - (3n^2 + 11n^4 - 7)$

13) $(-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$

14) $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

15) $(13n^2 + 11n - 2n^4) + (-13n^2 - 3n - 6n^4)$

16) $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

17) $(7 - 13x^3 - 11x) - (2x^3 + 8 - 4x^5)$

18) $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

19) $(3v^5 + 8v^3 - 10v^2) - (-12v^5 + 4v^3 + 14v^2)$

20) $(8b^3 - 6 + 3b^4) - (b^4 - 7b^3 - 3)$

21) $(k^4 - 3 - 3k^3) + (-5k^4 + 6k^3 - 8k^5)$

22) $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

23) $(-7n^2 + 8n - 4) - (-11n + 2 - 14n^2)$

24) $(14p^4 + 11p^2 - 9p^5) - (-14 + 5p^5 - 11p^2)$

25) $(8k + k^2 - 6) - (-10k + 7 - 2k^2)$

26) $(-9v^2 - 8u) + (-2uv - 2u^2 + v^2) + (-v^2 + 4uv)$

27) $(4x^2 + 7x^3y^2) - (-6x^2 - 7x^3y^2 - 4x) - (10x + 9x^2)$

28) $(-5u^3v^4 + 9u) + (-5u^3v^4 - 8u + 8u^2v^2) + (-8u^4v^2 + 8u^3v^4)$

29) $(-9xy^3 - 9x^4y^3) + (3xy^3 + 7y^4 - 8x^4y^4) + (3x^4y^3 + 2xy^3)$

30) $(y^3 - 7x^4y^4) + (-10x^4y^3 + 6y^3 + 4x^4y^4) - (x^4y^3 + 6x^4y^4)$

Name_____

# Multiplying Polynomials

Date_____ Period____

**Find each product.**

1) $6v(2v + 3)$

2) $7(-5v - 8)$

3) $2x(-2x - 3)$

4) $-4(v + 1)$

5) $(2n + 2)(6n + 1)$

6) $(4n + 1)(2n + 6)$

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

8) $(8p - 2)(6p + 2)$

9) $(6p + 8)(5p - 8)$

10) $(3m - 1)(8m + 7)$

11) $(2a - 1)(8a - 5)$

12) $(5n + 6)(5n - 5)$

13) $(4p-1)^2$

14) $(7x-6)(5x+6)$

15) $(6n+3)(6n-4)$

16) $(8n+1)(6n-3)$

17) $(6k+5)(5k+5)$

18) $(3x-4)(4x+3)$

19) $(4a+2)(6a^2-a+2)$

20) $(7k-3)(k^2-2k+7)$

21) $(7r^2-6r-6)(2r-4)$

22) $(n^2+6n-4)(2n-4)$

23) $(6n^2-6n-5)(7n^2+6n-5)$

Name_____

# Multiplying Special Case Polynomials

Date_____ Period____

**Find each product.**

1) $(x+5)(x-5)$

2) $(n-1)(n+1)$

3) $(p-1)^2$

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

5) $(x-4)^2$

6) $(n+3)^2$

7) $(x-5)(x+5)$

8) $(n-5)^2$

9) $(2k^2+1)^2$

10) $(8a^2+4)(8a^2-4)$

11) $(2+5n^2)^2$

12) $(3x-7)(3x+7)$

13) $(3+7v^2)(3-7v^2)$

14) $(7v^2-6)(7v^2+6)$

15) $(2+v)^2$

16) $(6v+3)(6v-3)$

17) $(8a^2-2)(8a^2+2)$

18) $(4a+7)^2$

19) $(2n-7)^2$

20) $(-m+5n)(-m-5n)$

21) $(7u+4v)(7u-4v)$

22) $(-y-3x)(-y+3x)$

23) $(-9x^2-10y)^2$

24) $(4u+9v)^2$

25) $(7u+6v)(7u-6v)$

26) $(-6x-7y^2)^2$

Name_____

# Factoring Special Cases

Date_____ Period____

**Factor each completely.**

1) $16n^2 - 9$

2) $4m^2 - 25$

3) $16b^2 - 40b + 25$

4) $4x^2 - 4x + 1$

5) $9x^2 - 1$

6) $n^2 - 25$

7) $n^4 - 100$

8) $a^4 - 9$

9) $k^4 - 36$

10) $n^4 - 49$

11) $98n^2 - 200$

12) $3 + 6b + 3b^2$

13) $400 - 36v^2$

14) $100x^2 + 180x + 81$

15) $10n^2 + 100n + 250$

16) $49n^2 - 56n + 16$

17) $49x^2 - 100$

18) $1 - r^2$

19) $10p^3 - 1960p$

20) $343b^2 - 7b^4$

21) $81v^4 - 900v^2$

22) $200m^4 + 80m^3 + 8m^2$

Name _____ Date _____Score

**Algebra I CC Unit 9 Review: Polynomial Expressions and Functions: No Calculators**

1. Which situation could be represented by the function $f(x) = 25 + x^2$?

   **A.** A feather being dropped from 25ft

   **B.** A population begins at 25 and increases exponentially over time.

   **C.** John has $25 in his savings. Each week he increases his savings by 5%.

   **D.** A 5 inch by 5 inch piece of metal has an $x$ inch by $x$ inch square added to it.

2. One way to factor $x^8 + x^4 + 26$ is to first rewrite the expression as $y^2 + y + 26$. What is the equivalent of $y$?

***This is a Multiple Choice Problem***

3. Find the product of $(x^2 + 3x - 6)(4x^2 - 3x - 1)$

***This is a Multiple Choice Problem***

4. Simplify $(x + y)^2$. Simplify $(x - y)^2$.

***This is a Multiple choice Multiple answer Problem***

5. Find all of the roots of $2x^6 + 2x^5 = 60x^4$ Show all work used to determine your answer.

6. A student says that the expression $(b + 3a)^2$ will always result in a positive answer. Defend or refute the student's statement.

7. Factor completely: $3x^3 + 21x^2 + 30x$

8. Factor completely: $3x^2 - 12$.

9. Factor the expression $81a^2 - 36$ and solve for the zeros of the related function.

10. A baseball player hits a ball that can be modeled by $f(x) = -12x^2 + 30x + 72$. When will the ball hit the ground?

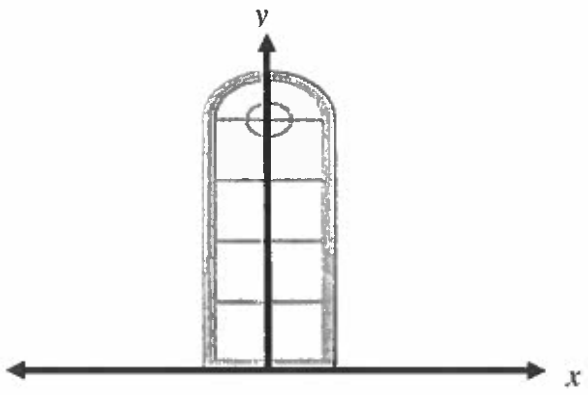
**11.** One side of a rectangle is 3 in. longer than twice the other side. Find the sides if the area of the rectangle is 65 $in^2$.

**12.** Simplify $(2x^3 - 3x^2 + 4x - 7) - (x^3 - 3x + 6)$.

**13.** The number of apples produced can be modeled by the expression $-a^2 + 75a + 200$. The average weight can be modeled by the expression $-2a^2 + 100a - 30$. Write a polynomial that models the weight of each apple.

**14.** The window shown below is in the shape of a parabola. The base of the window lies along the $x$-axis. Factor the equation below to determine the height of the window and its $x$-intercepts.

$$-5x^2 + 125 = 0$$



15. Use the quadratic function $f(x) = x^2 - 6x + 8$.

**a.** Identify the zeros of $f(x)$. **(2 points)**

**b.** Graph $f(x)$. **(3 points)**