Precalculus Essentials
Summer Assignment

The following assignment contains important prerequisite topics for Precalculus. You will be responsible for the content when you return to school in September. This assignment is MANDATORY and will be graded.

Resources:

- Get ready for Precalculus | Math
- Unit 1 Polynomials - Algebra 2 Common Core
- Unit 2 Polynomial Functions - Algebra 2 Common Core
- Unit 8 Functions - Algebra 1 Common Core
- Unit 9 Factoring - Algebra 1 Common Core
- Unit 10 Quadratics - Algebra 1 Common Core
- Unit 11 Solving Quadratics - Algebra 1 Common Core

Important References

Properties of Radicals

$\sqrt[n]{a} = a^{\frac{1}{n}}$ $\qquad$ $\sqrt[n]{ab} = \sqrt[n]{a}\sqrt[n]{b}$

$\sqrt[m]{\sqrt[n]{a}} = \sqrt[nm]{a}$ $\qquad$ $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

$\sqrt[n]{a^n} = a$, if n is odd

$\sqrt[n]{a^n} = |a|$, if n is even

Properties of Absolute Value

$$|a| = \begin{cases} a & \text{if } a \ge 0 \\ -a & \text{if } a < 0 \end{cases}$$

$|a| \ge 0$ $\qquad$ $|-a| = |a|$

$|ab| = |a||b|$ $\qquad$ $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$

Complex Numbers

$i = \sqrt{-1}$ $\qquad$ $i^2 = -1$ $\qquad$ $\sqrt{-a} = i\sqrt{a}, \quad a \ge 0$

$(a+bi)+(c+di) = a+c+(b+d)i$

$(a+bi)-(c+di) = a-c+(b-d)i$

$(a+bi)(c+di) = ac-bd+(ad+bc)i$

$(a+bi)(a-bi) = a^2+b^2$

$|a+bi| = \sqrt{a^2+b^2}$ Complex Modulus

$\overline{(a+bi)} = a-bi$ Complex Conjugate

$\overline{(a+bi)}(a+bi) = |a+bi|^2$

Exponent Properties

$a^n a^m = a^{n+m}$ $\qquad$ $\frac{a^n}{a^m} = a^{n-m} = \frac{1}{a^{m-n}}$

$(a^n)^m = a^{nm}$ $\qquad$ $a^0 = 1, \quad a \ne 0$

$(ab)^n = a^n b^n$ $\qquad$ $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$a^{-n} = \frac{1}{a^n}$ $\qquad$ $\frac{1}{a^{-n}} = a^n$

$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}$ $\qquad$ $a^{\frac{n}{m}} = \left(a^{\frac{1}{m}}\right)^n = \left(a^n\right)^{\frac{1}{m}}$

Parabola/Quadratic Function

$y = a(x-h)^2 + k$ $\qquad$ $f(x) = a(x-h)^2 + k$

The graph is a parabola that opens up if $a > 0$ or down if $a < 0$ and has a vertex at (h,k).

Quadratic Formula

Solve $ax^2 + bx + c = 0$, $a \ne 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

If $b^2 - 4ac > 0$ - Two real unequal solns.

If $b^2 - 4ac = 0$ - Repeated real solution.

If $b^2 - 4ac < 0$ - Two complex solutions.

Parabola/Quadratic Function

$y = ax^2 + bx + c$ $\qquad$ $f(x) = ax^2 + bx + c$

The graph is a parabola that opens up if $a > 0$ or down if $a < 0$ and has a vertex at $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$.

Line/Linear Function

$y = mx + b$ or $f(x) = mx + b$

Graph is a line with point $(0, b)$ and slope m.

Slope

Slope of the line containing the two points (x_1, y_1) and (x_2, y_2) is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

Slope – intercept form

The equation of the line with slope m and y-intercept $(0, b)$ is

$$y = mx + b$$

Point – Slope form

The equation of the line with slope m and passing through the point (x_1, y_1) is

$$y = y_1 + m(x - x_1)$$

Parabola/Quadratic Function

$y = a(x-h)^2 + k$ $f(x) = a(x-h)^2 + k$

The graph is a parabola that opens up if $a > 0$ or down if $a < 0$ and has a vertex at (h, k).

Parabola/Quadratic Function

$y = ax^2 + bx + c$ $f(x) = ax^2 + bx + c$

The graph is a parabola that opens up if $a > 0$ or down if $a < 0$ and has a vertex at $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$.

Factoring

Difference of two squares

$a^2 - b^2 = (a - b)(a + b)$

Difference of two cubes

$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$

Sum of Cubes

$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$

Name: _____

Simplify the following:

1. $x^2 y\left(3x^3 + 4xy + y^2\right)$	2. $\sqrt{75}$
3. $\dfrac{w^3 x^2}{w x^{-3}}$	4. $\left(\sqrt{5}+1\right)\left(\sqrt{5}-1\right)$
5. $\dfrac{4}{2-\sqrt{2}}$	6. $\dfrac{x^2+8x+15}{x^2+3x}$
7. $\dfrac{4}{1-3i}$	8. $\left(2-5i\right)\left(2+5i\right)$

Factor and solve.

9. $x^2 - 4x - 5 = 0$	10. $2x^2 - 32 = 0$
11. $x^4 + 6x^3 + 9x^2 = 0$	12. $x^3 + 2x^2 - 16x - 32 = 0$
13. $x^3 + 27 = 0$	14. $x^4 - x^2 - 12 = 0$

Solve the following:

15. $3x - 7 = 4$	16. Solve for x in terms of a and b: $2ax + bx + 7 = 11$
17. $\frac{3m - 2}{5} = 6m$	18. $1 - 4d > 4 - d$
19. $\begin{cases} 3x - y = 4 \\ x + 5y = -4 \end{cases}$	20. $x^2 - 10x + 3 = 0$

Solve the following:

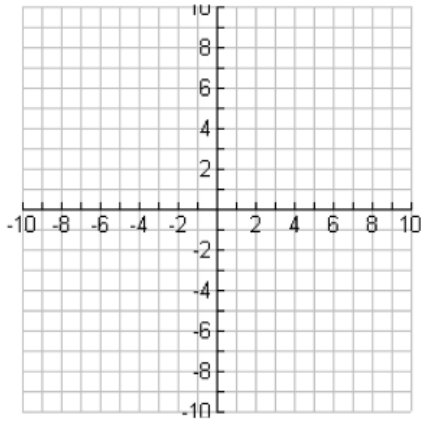
21. $3\|x-4\|=9$	22. $4\|x-1\|>12$

Given $f(x)=3x^2$ **and** $g(x)=-2x+5$ **find the following:**

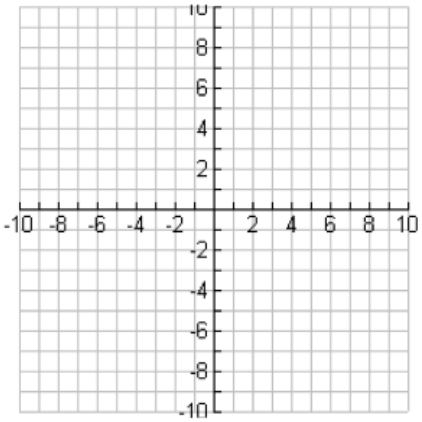
23. $f(-3)$	24. $-g(\frac{1}{2})$
25. $f(g(1))$	26. $g(g(-3))$

Solve the following:

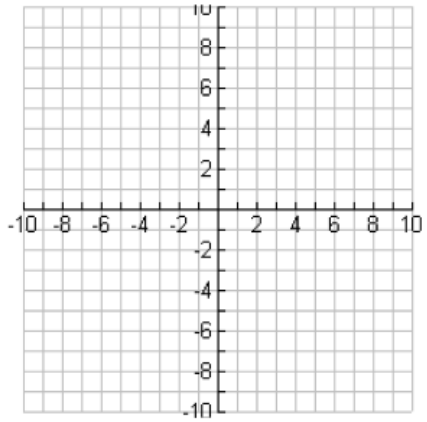
27. Find the equation of the line passing through (-2, 4) and (1, 7).



28. Find the equation of a line perpendicular to $2x - 5y = 12$ passing through the point (1, -2). Graph it.



29. Graph the parabola $y = \frac{1}{2}x^2 - 2x + 1$. Label the vertex and axis of symmetry.



30. Graph the parabola $y = x^2 + 4x + 4$. Label the vertex and axis of symmetry.