Precalculus Summer Review

I. Polynomials and operations on real and imaginary numbers.

A. Simplify these expressions

1. $\sqrt{-100}$
2. $\sqrt{-4 \cdot -9}$

3. $(i\sqrt{7})^2$
4. $\sqrt[3]{2x} \cdot \sqrt[3]{4x^2 y^2} \cdot \sqrt[3]{2y^4}$

5. $(3 + 2i) + (5 + 7i)$
6. $2i\,(3 - i)$

7. $(3 + 2i)\,(3 - 2i)$
8. $\sqrt{\dfrac{-r}{5}} \cdot \sqrt{\dfrac{-20}{r}}$

9. $\dfrac{8}{-2i}$
10. $(3 + i\sqrt{5})^2$

11. $-\sqrt{-9}$
12. $\dfrac{5i}{6 - 2i}$ (Hint: Use the conjugate of denominator)

B. Factor Completely

1. $t^2 - 4t - 21$
2. $x^3 - 8$

3. $27x^3 + 125$
4. $x^3 - 2x^2 - 4x + 8$

C. Simplify the following expressions.

1. $5x^2 \cdot 2x^5$
2. $(-2c^3)^2$

3. $\dfrac{4^{h-k}}{4^{h+k}}$
4. $\dfrac{10 \cdot 2^6}{8 \cdot 2^{-2}}$

5. $t^3 \cdot t^{\,n-3}$
6. $(x^m)^{\,n} \cdot (x^n)^{\,n-m}$

D. Divide and simplify these expressions.

1. $\dfrac{x^2 + 2x - 1}{x + 3}$

2. $\dfrac{3x^4 - 2x^3 + 16x - 192}{x^2 - 8}$

E. Solve each quadratic equation for x

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

2. $2x(x - 4) = 3(1 - x)$

3. $2x^2 + 4x = -3$

4. $2x^2 - 32x = 0$

F. On a separate piece of paper, graph the functions using a table of values, symmetry, rational zero theorem, or other properties of polynomials to plot points.   Verify the graph with the calculator. Describe the following characteristics for each function:
   a.   domain and range   b. zeros   c. y-intercept   d. end behavior
   e.   intervals where the function is increasing / ...   decreasing

1. $f(x) = x^3 - 3x^2 + x + 1$

2. $f(x) = x^2 + 2x + 1$

3. $f(x) = 3x^2 + 2x + 1$

4. $f(x) = \sqrt{x - 5}$

5. $f(x) = -\sqrt{x - 5}$

6. $f(x) = \sqrt{x} + 5$

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II. Function Operations

If $f(x) = x^2 - 4$ and $g(x) = \sqrt{2x+4}$, determine

1. $f(3)$

2. $f(x) = 0$ when $x = ?$

3. $f^{-1}(x)$

4. Is the inverse of $f(x)$ a function?

III. Rational Expressions and Rational Functions

A. Graph the following functions using a table of values.   Identify:
   a.   intercepts   **b. asymptotes**

1. $f(x) = \dfrac{2x}{x+4}$

2. $h(x) = \dfrac{3x}{x^2 + 1}$

3. $k(x) = \dfrac{4x^2}{x^2 - 9}$

B. Simplify. Write your answer as a single fraction.

1. $\dfrac{3x^2 + 6x^3}{9x}$

2. $\dfrac{x^2 - 25}{x^2 + 7x + 10}$

3. $\dfrac{2x}{x+5} \div \dfrac{6x^2}{2x+10}$

4. $\dfrac{\dfrac{3}{x+2}}{\dfrac{6}{x}}$

5. $\dfrac{x-2}{x} + \dfrac{x+4}{2x}$

6. $\dfrac{4x}{x+6} + 2$

IV. Rewriting and Solving Equations

A. Solve each equation for y.

1. $7y + 6x = 10$

2. $\dfrac{1}{4}y - 7x = \dfrac{15}{2}$

B.   Find the solution(s) of the given systems of equations. Write answers in the form (x, y).
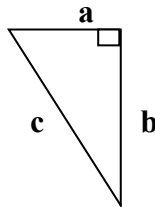
1. $-2x - 5y = 7$
    $7x + y = -8$

2. $4x + 9y = 2$
    $2x + 6y = 1$

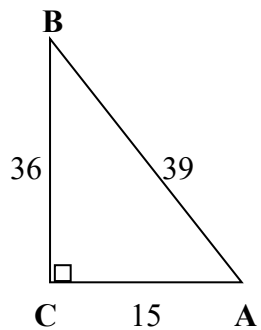## V. Pythagorean Theorem and Trigonometric Ratios

A. Solve for the missing side of the triangle using the Pythagorean Theorem:

1. a = 6 ft.   b = 8 ft.

2. b = 17 ft.   c = 19 ft.

C. Given the right triangle, determine the trigonometric ratios.
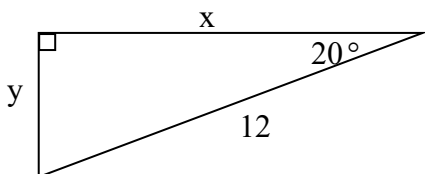
B

36   39

C   15   A

1. sin A   2. cos A   3. tan A

D. Use trig ratios to solve for x and y in each right triangle. Round answers to three places after the decimal point.

1.

x

20°

y

12

2.

x

18

y

28