

Name: _____

CC Algebra 2R Midterm Review #2

- 1) Given i is the imaginary unit, $(2 - yi)^2$ in simplest form is

- 1) $y^2 - 4yi + 4$
 2) $-y^2 - 4yi + 4$
 3) $-y^2 + 4$
 4) $y^2 + 4$

$$\begin{array}{c} 2 \quad -yi \\ \hline 2 \quad | \quad 4 \quad -2yi \\ -yi \quad | \quad -2yi \quad y^2 i^2 \\ \hline \quad \quad \quad -y^2 \end{array}$$

$$4 - 4yi - y^2$$

- 2) Which factorization is *incorrect*?

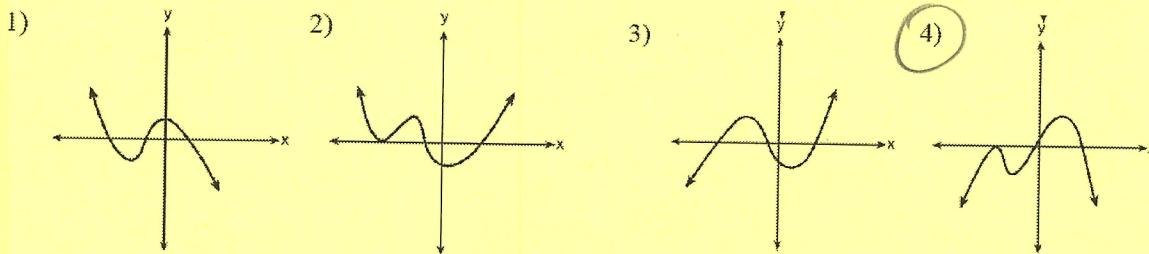
- 1) $4k^2 - 49 = (2k + 7)(2k - 7)$ DOTS ✓
 2) $a^3 - 8b^3 = (a - 2b)(a^2 + 2ab + 4b^2)$ ✓
 3) $m^3 + 3m^2 - 4m + 12 = (m - 2)^2(m + 3)$
 4) $t^3 + 5t^2 + 6t + t^2 + 5t + 6 = (t + 1)(t + 2)(t + 3)$

$$\begin{array}{c} a^2 \quad 2ab \quad 4b^2 \\ \hline a^3 \quad | \quad 2a^2b \quad | \quad 4ab^2 \\ -2b \quad | \quad -2a^2b^2 \quad -4ab^2 \quad -8b^3 \end{array}$$

$$\begin{array}{c} (3) \quad (m - 2)^2 = m^2 - 4m + 4 \\ m^2 \quad -4m \quad 4 \\ \hline m^3 \quad | \quad -4m^2 \quad | \quad 4m \\ 3 \quad | \quad 3m^2 \quad -12m \quad | \quad 12 \\ \hline m^3 - m^2 - 8m + 12 \end{array}$$

- 3) Which graph has the following characteristics?

- three real zeros
- as $x \rightarrow -\infty, f(x) \rightarrow -\infty$
- as $x \rightarrow \infty, f(x) \rightarrow -\infty$



- 4) The solution set for the equation $\sqrt{56 - x} = (x)$ is

- 1) $\{-8, 7\}$
 2) $\{-7, 8\}$
 3) $\{7\}$
 4) $\{\}$

$$\begin{aligned} 56 - x &= x^2 \\ 0 &= x^2 + x - 56 \\ 0 &= (x+8)(x-7) \\ x &= -8 \quad x = 7 \end{aligned}$$

$$\begin{aligned} \text{check} \\ x = -8 &\quad x = 7 \\ \sqrt{56 - (-8)} &= -8 \quad \sqrt{56 - 7} = 7 \\ 16 &\neq -8 \quad 7 = 7 \quad \checkmark \end{aligned}$$

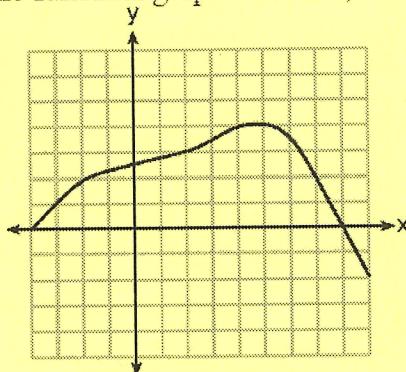
5) The zeros for $f(x) = x^4 - 4x^3 - 9x^2 + 36x$ are

- (1) $\{0, \pm 3, 4\}$
 2) $\{0, 3, 4\}$
 3) $\{0, \pm 3, -4\}$
 4) $\{0, 3, -4\}$
- $$x(x^3 - 4x^2 - 9x + 36)$$
- $$x(x^2(x-4) - 9(x-4))$$
- $$x(x^2 - 9)(x-4)$$
- $$x(x+3)(x-3)(x-4)$$

6) The expression $\sqrt{-180x^{16}}$ is equivalent to

- 1) $-6x^4\sqrt{5}$
 2) $-6x^8\sqrt{5}$
 3) $6x^4i\sqrt{5}$
 4) $6x^8i\sqrt{5}$
- $$i\sqrt{180x^{16}}$$
- $$i\sqrt{360x^{16}}\sqrt{5}$$
- $$6x^8i\sqrt{5}$$

7) Which value is in the domain of the function graphed below, but is *not* in its range?



- 1) 0 $D = [-4, 9]$
 2) 2
 3) 3
 4) 7 $R = [-2, 4]$

8) The expression $\frac{4x^3 + 5x + 10}{2x + 3}$ is equivalent to

- 1) $2x^2 + 3x - 7 + \frac{31}{2x + 3}$
 2) $2x^2 - 3x + 7 - \frac{11}{2x + 3}$
 3) $2x^2 + 2.5x + 5 + \frac{15}{2x + 3}$
 4) $2x^2 - 2.5x - 5 - \frac{20}{2x + 3}$

$$\begin{array}{r} 2x^2 - 3x + 7 \\ 2x + 3 \overline{)4x^3 + 0x^2 + 5x + 10} \\ \underline{-4x^3 - 6x^2} \\ -6x^2 + 5x \\ \underline{+6x^2 + 9x} \\ 14x + 10 \\ \underline{-14x - 21} \\ -11 \end{array}$$

- 9) The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

Year	1898	1971	1985	2006	2012
Cost (¢)	1	6	14	24	35

1)

$$\frac{6-1}{1971-1898} \approx 0.068$$

$$3) \frac{24-14}{2006-1985} \approx 0.476$$

1) 1898-1971

2) 1971-1985

3) 1985-2006

4) 2006-2012

$$2) \frac{14-1}{1985-1971} \approx 0.929$$

$$4) \frac{35-24}{2012-2006} \approx 1.833$$

- 10) If $f(x) = 2x^2 - 3x + 4$, then $f(x+3)$ is equal to

1) $2x^2 - 3x + 7$

2) $2x^2 - 3x + 13$

3) $2x^2 + 9x + 13$

4) $2x^2 + 9x + 25$

$$f(x+3) = 2(x+3)^2 - 3(x+3) + 4$$

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

$$= 2x^2 + 12x + 18 - 3x - 9 + 4 \rightarrow$$

$$2x^2 + 9x + 13$$

- 11) If $f(x) = x^2 - x$ and $g(x) = x + 1$, determine $f(g(x))$ in simplest form.

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

$$= x^2 + 2x + 1 - x - 1$$

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

- 12) Solve the system of equations shown below algebraically.

$$(x-3)^2 + (y+2)^2 = 16$$

$$(5-y-3)^2 + (y+2)^2 = 16$$

$$2x + 2y = 10 \rightarrow x = 5 - y$$

$$(2-y)^2 + (y+2)^2 = 16$$

$$\begin{cases} (7, -2) \\ (3, 2) \end{cases}$$

$$4 - 4y + y^2 + y^2 + 4y + 4 = 16$$

Plug in y

$$y = -2$$

$$2y^2 - 8 = 0$$

$$2x + 2(-2) = 10$$

$$y = 2$$

$$2(y^2 - 4) = 0$$

$$2x = 14$$

$$2x + 2(2) = 10$$

$$2(y+2)(y-2) = 0$$

$$x = 7$$

$$2x = 6$$

$$13) \text{ Simplify: } \frac{1 - \frac{1}{x} - \frac{6}{x^2}}{1 - \frac{4}{x} + \frac{3}{x^2}}$$

$$x = 3$$

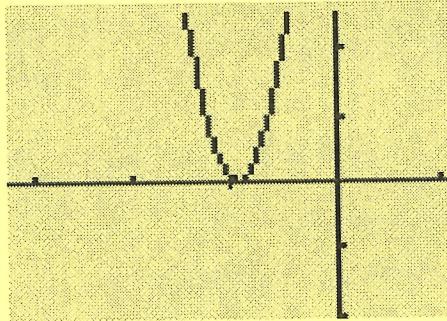
LCD: x^2

$$x^2 \frac{1}{1} - \frac{1}{x} \frac{x^2}{x^2} - \frac{6}{x^2} \frac{x^2}{x^2}$$

$$x^2 \frac{1}{1} - \frac{4}{x} \frac{x^2}{x^2} + \frac{3}{x^2} \frac{x^2}{x^2}$$

$$\frac{x^2 - x - 6}{x^2 - 4x + 3} = \frac{(x-3)(x+2)}{(x-3)(x-1)} = \boxed{\frac{(x+2)}{(x-1)}}$$

- 14) Consider the polynomial function $g(x) = x^4 + 2x^3 + 10x^2 + 18x + 9$ and its graph below.



- a. Based on the appearance of the graph, what does the real solution to the equation $x^4 + 2x^3 + 10x^2 + 18x + 9 = 0$ appear to be?

$$x = -1 \quad (\text{double root})$$

- b. Using the graph, what must be a factor of the polynomial graphed above?

$$(x+1)$$

- c. Find the two complex number zeros of $y = g(x)$.

$$\begin{array}{r} -1 | 1 & 2 & 10 & 18 & 9 \\ \downarrow -1 & -1 & -9 & -9 \\ 1 & 1 & 9 & 9 & 0 \end{array}$$
$$x^3 + x^2 + 9x + 9 = 0$$
$$x^2(x+1) + 9(x+1) = 0$$
$$(x^2 + 9)(x+1) = 0$$
$$x^2 + 9 = 0$$
$$x^2 = -9$$
$$x = \pm 3i$$

- d. Using the solution from parts a-c, express the polynomial in terms of linear factors.

$$g(x) = (x+1)(x+1)(x+3i)(x-3i)$$

$$LCD: (x-2)(x+5)$$

15) Add and fully simplify: $\frac{3}{(x+5)} \frac{1}{x-2} + \frac{7}{x+5} \frac{1}{(x-2)}$

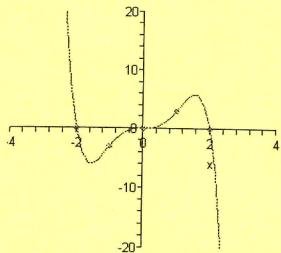
$$\frac{3(x+5) + 7(x-2)}{(x-2)(x+5)} = \frac{3x+15+7x-14}{(x-2)(x+5)} = \boxed{\frac{(10x+1)}{(x-2)(x+5)}}$$

16) Perform the indicated operations and fully simplify: $\frac{x^2-4}{x^2+2x-15} \cdot \frac{x^2-2x-3}{6x+42} \div \frac{x^2+2x}{9x^2+45x}$

$$\frac{(x+2)(x-2)}{(x+5)(x-3)} \cdot \frac{(x-3)(x+1)}{2(x+7)} \cdot \frac{3x(x+5)}{x(x+2)} = \boxed{\frac{3(x-2)(x+1)}{2(x+7)}}$$

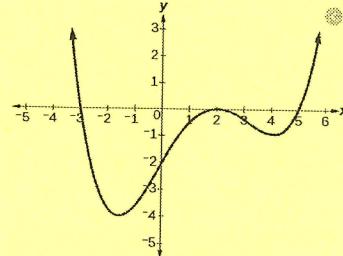
17) Write the equation of the following graphs in factored form.

a.



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

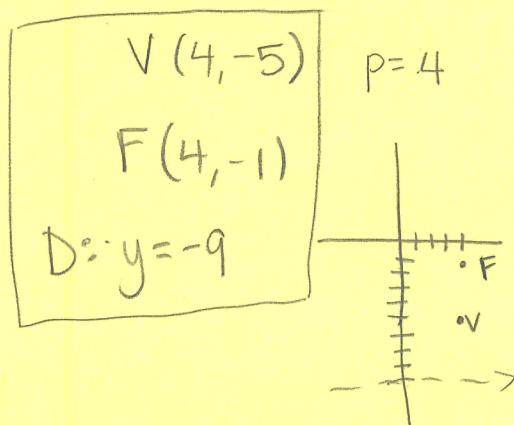
b.



$$f(x) = (x+3)(x-2)^2(x-5)$$

18) Determine the vertex, focus and directrix of the following parabolas:

a. $y = \frac{1}{16}(x-4)^2 - 5$



b. $x = \frac{1}{20}(y+2)^2 - 3$

