Algebra 2
Midterm Review

Name: Key
Date: _____ Block: __

UNIT I: QUADRATICS REVISITED

Factor the following completely:

A) $x^2 + 5x - 50$ $(x+10)(x-5)$	B) $x^2 - 169$ $(x+13)(x-13)$	C) $x^2 - 5x - 126$ $(x+9)(x-14)$
D) $6x^2 - 54$ $6(x^2-9)$ $6(x+3)(x-3)$	~~E)~~ $15x^3 + 25x^2 - 40x^4$ OMIT	F) $3x^2 - 8x + 5$ $x^2-8x+15$ $(3x-5)(x-1)$ $(x-5)(x-3)$
G) $5x^2 - 8x - 4$ $x^2-8x-20$ $(x-\frac{10}{5})(x+\frac{2}{5})$ $(x-2)(5x+2)$		

Solve by factoring.

A) $x^2 + 4x + 4 = 0$ $x=-2$ mult. 2	B) $2x^3 - 50x = 0$ $2x(x^2-25)=0$ $2x(x+5)(x-5)=0$ $x=0, \pm 5$	C) $3x^3 + 39x^2 + 90x = 0$ $3x(x^2+13x+30)$ $3x(x+10)(x+3)$ $x=0,-10,-3$

Simplify completely.

A. i^{27} $-i$	B. $(-8+i)-(-23-20i)$ $+23+20i$ $15+21i$
C. $20-(2+7i)-23i$ $20-2-7i-23i$ $18-30i$	D. $5+\sqrt{-225}$ $5+15i$
E. $7\sqrt{-50}$ $35i\sqrt{2}$	F. $(9+9i)(2-i)$ $27+9i$
G. $(6-4i)^2$ $20-48i$	H. What is the complex conjugate of $-3+5i$? $-3-5i$
I. $\frac{1+2i}{6+i}$ $\frac{8+11i}{37}$	

SOLVE BY USING THE SQUARE ROOT METHOD

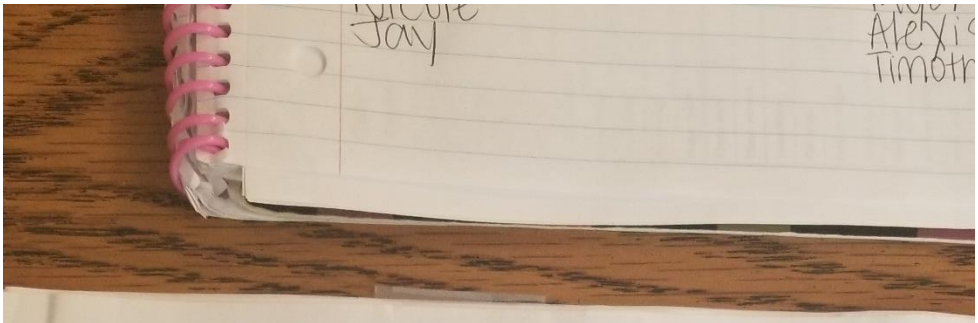
A) $x^2 + 3 = 0$	B) $2x^2 - 9 = 119$	C) $(3x - 1)^2 + 12 = 0$
$x = \pm i\sqrt{3}$	$2x^2 = 128$ $x^2 = 64$ $x = \pm 8$	$(3x-1)^2 = -12$ $3x - 1 = \pm 2i\sqrt{3}$ $3x = 1 \pm 2i\sqrt{3}$ $x = \frac{1 \pm 2i\sqrt{3}}{3}$

Find the discriminant of the quadratic equation and complete the table. Do NOT solve the equation.

Equation	Discriminant	Describe the number & types of solutions
$x^2 + 8x + 2 = 0$	56	2 Real
$x^2 + x + 1 = 0$	-3	2 Imaginary
$4x^2 + 3x - 5 = 0$	89	2 Real
$5x^2 - 2x + 6 = 0$	-116	2 Imaginary

SOLVE USING THE QUADRACTIC FORMULA

A) $x^2 + 7x + 8 = 0$	B) $-3x^2 + 4x = 6$	C) $6x^2 + 2x - 10 = 0$
$x = \frac{-(7) \pm \sqrt{(7)^2 - 4(1)(8)}}{2(1)}$ $x = \frac{-7 \pm \sqrt{17}}{2}$	$x = \frac{-(4) \pm \sqrt{(4)^2 - 4(-3)(-6)}}{2(-3)}$ $= \frac{-4 \pm \sqrt{-56}}{-6}$ $= \frac{-4 \pm 2i\sqrt{14}}{-6}$ $x = \frac{-2 \pm i\sqrt{14}}{-3}$	$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(6)(-10)}}{2(6)}$ $= \frac{-2 \pm \sqrt{244}}{12}$ $= \frac{-2 \pm 2\sqrt{61}}{12}$ $x = \frac{-1 \pm \sqrt{61}}{6}$



UNIT 2: OPERATIONS WITH POLYNOMIALS AND FACTORING

1.) Write the polynomial $5x - x^2 - 2x^5 - 1$ in standard form.

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

2.) Classify the polynomial 5x by degree and number of terms.

D: Linear

# of Terms: Monomial

3.) Classify the polynomial $3x^3 + 4x$ by degree and number of terms.

D: Cubic

# of Terms: Binomial

4.) Classify the polynomial $x^4 + x^2 - x + 4$ by degree and number of terms.

D: Quartic

# of Terms: Polynomial

Simplify completely.

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

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

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

6.) $(-3x^2 - 2x^3 + 5x) + (-9x^3 + 6x^2 + 11x)$

$-11x^3 + 3x^2 + 16x$

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

$-6x^4 + 21x^2 - 3x$

8.) $(x + 6)(x - 4)$

$x^2 + 2x - 24$

9.) $(5x+10)^2$

$(5x + 10)(5x + 10)$

$25x^2 + 50x + 50x + 100$

$25x^2 + 100x + 100$

10.) $(7x^4 + 6x^3 - 3x^2)(x^3 + 8x)$

$7x^7 + 56x^5 + 6x^6 + 48x^4 - 3x^5 - 24x^3$

$7x^7 + 6x^6 + 53x^5 + 48x^4 - 24$

Divide using synthetic division.

11.) $(x^3+6x^2-x-30)\div(x-2)$

2 | 1 6 -1 -30
↓ 2 16 30
1 8 15 ∅

$x^2+8x+15$

12.) $(2x^4+6x^3-3x^2-1)\div(x+3)$

$2x^3-3x+9+\frac{-28}{x+3}$

Factor each of the expressions completely.

13.) $2x^3+5x^2-6x-15$

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

14.) $3x^3-81$

$3(x^3-27)$

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

15.) x^4-18x^2+32

$(x^2-16)(x^2-2)$

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

16.) $2x^3+16$

$2(x^3+8)$

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

Solve each of the equations by factoring.

17.) $x^3=x^2+12x$

$x=0, x=4, x=-3$

18.) $x^3-3x^2-x+3=0$

$x=-1, 1, 3$

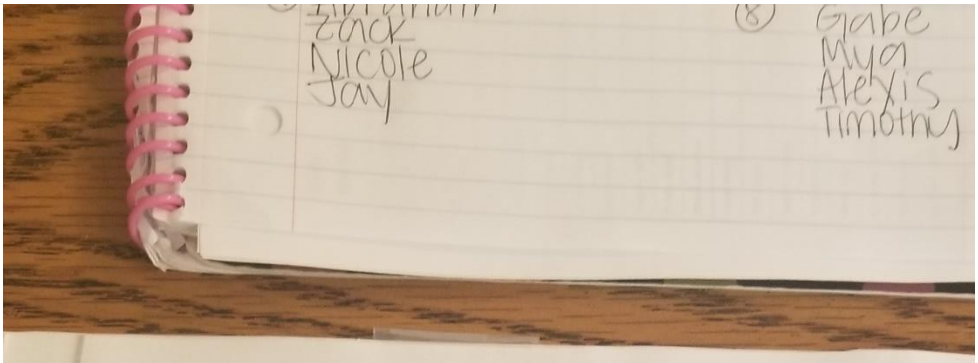
19.) $x^4+5x^2-24=0$

$x=\pm 2i\sqrt{2}$

$x=\pm\sqrt{3}$

20.) $x^3+64=0$

$x=-4, 2\pm 2i\sqrt{3}$



UNIT 3: POLYNOMIALS - FINDING ZEROS & GRAPHING

1. Use the Remainder Theorem to evaluate the function $f(x) = -x^3 - 2x^2 + x; \quad x = 4$

4 | -1 -2 1 0
↓ -4 -24 -92
-1 -6 -23 -92

$f(4) = -92$

2. Use the Remainder Theorem to determine whether x = -5 is a zero of the polynomial function $f(x) = x^3 + x^2 - 16x + 20$. Show work and EXPLAIN in complete sentences.

-5 | 1 1 -16 20
↓ -5 20 -20
1 -4 +4 ϕ

x = -5 is a zero because the remainder equals zero.

3. Find d so that $x = 4$ is a zero of the polynomial $f(x) = x^4 - 18x^2 + d$.

4 | 1 0 -18 0 d
↓ 4 16 -8 -32
1 4 -2 -8 ϕ

$d = 32$

4. List all of the possible, rational, real roots of the function $f(x) = 2x^4 + 5x^3 - 6x^2 - 7x + 4$

$\frac{4}{2} = \frac{1, 2, 4}{1, 2}$

$\pm 1, \pm 2, \pm 4, \pm 1/2$

5. Find all the zeros of the polynomial $f(x) = x^3 + x^2 - 4x - 4$

$x = -2, -1, 2$

6. Find all of the zeros of the function $f(x) = x^3 + x^2 + 9x + 9$

$-1, \pm 3i$

-1 | 1 1 9 9
↓ -1 0 -9
1 0 9 ϕ

$x^2 + 9 = 0$
$x^2 = -9$

7. Find all zeros of the function $g(x) = 3x^3 - 8x^2 + 7x - 2$

1, mult. 2, 2/3

1 | 3 -8 7 -2
↓ 3 -5 2
3 -5 2 ϕ

$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(2)}}{2(3)}$

$\frac{5 \pm \sqrt{1}}{6} = \frac{5 \pm 1}{6}$ → $\frac{5+1}{6} = 1$, $\frac{5-1}{6} = 4/6$

Nicole
Jay

Myah
Alexis
Timothy

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4. List all of the possible, rational, real roots of the function $f(x) = 2x^4 + 5x^3 - 6x^2 - 7x + 4$

$\frac{4}{2} = \frac{1, 2, 4}{1, 2}$

$\pm 1, \pm 2, \pm 4, \pm 1/2$

5. Find all the zeros of the polynomial $f(x) = x^3 + x^2 - 4x - 4$

$X = -2, -1, 2$

6. Find all of the zeros of the function $f(x) = x^3 + x^2 + 9x + 9$

$-1, \pm 3i$

-1 | 1 1 9 9
↓ -1 0 -9
1 0 9 ϕ

$x^2 + 9 = 0$
$x^2 = -9$

7. Find all zeros of the function $g(x) = 3x^3 - 8x^2 + 7x - 2$

1, mult. 2, 2/3

1 | 3 -8 7 -2
↓ 3 -5 2
3 -5 2 ϕ

$X = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(3)(2)}}{2(3)}$

$\frac{5 \pm \sqrt{1}}{6} = \frac{5 \pm 1}{6}$ → $\frac{5+1}{6} = 1$, $\frac{5-1}{6} = 4/6$

8. How many solutions does the equation $7k^3 + 5k^4 - k^2 + 4 = 0$ have? Explain how you know in complete sentences.

There are 4 answers because the degree is 4.

9. If $-\sqrt{6}$ is a zero of a polynomial function, what must also be a zero?

$\sqrt{6}$

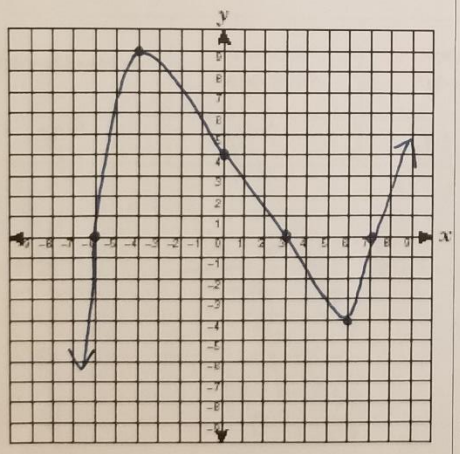
10. If $2+9i$ is a zero of a polynomial function, what must also be a zero?

$2-9i$

11. Given the function $f(x) = (2x)^2(x+4)^4(x-1)^3$, state the zeros of the function including multiplicity.

X = 0 mult. 2, X = -4 mult. 4, X = 1 mult. 3

Use the graph below to answer questions 12 – 24:



12.) Determine the domain of the polynomial:
$\mathbb{R}$

13.) Determine the range of the polynomial:
$\mathbb{R}$

14.) Determine the x-intercepts of the polynomial:
(-6,0), (3,0), (7,0)

15.) Determine the zeros of the polynomial:
-6, 3, 7

16.) Determine the y-intercept of the polynomial:
(0,4)

17.) Determine the interval(s) of increase:
$(-\infty, -4) \cup (6, \infty)$

18.) Determine the interval(s) of decrease:
(-4, 6)

19.) Determine the relative minimum:
(6, -4)

20.) Determine the relative maximum:
(-4, 9)

21.) Determine the absolute minimum:
N/A

22.) Determine the absolute maximum:
N/A

23.) Determine if the polynomial is even/odd or neither:
Neither

24.) Determine the end behavior of the polynomial:
as x $\to \infty$, f(x) $\to \infty$
as x $\to -\infty$, f(x) $\to -\infty$

25.) Sketch the graph of the polynomial function $f(x) = x^3 + 2x^2$

Number of Turns: 2

Zeros (w/multiplicity):

0 mult. 2

-2

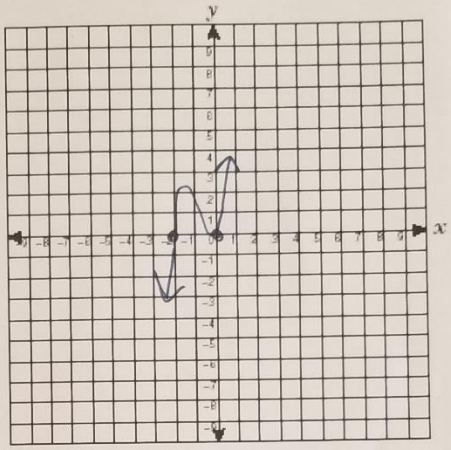
Y-Intercept:

(0,0)

End Behavior:

as x → ∞, f(x) → ∞

as x → -∞, f(x) → -∞



27.) $y = -(x+2)^3 - 5$

Parent Function:	Vertical Reflection?	Horizontal Reflection?	Horizontal Shift? Direction? How many?	Vertical Shift? Direction? How many?
x^3	yes x	NO	← 2 .	↓ 5 .

x	y
-2	-8
-1	-1
0	0
1	1
2	8

x-2	-y-5
-4	3
-3	-4
-2	-5
-1	-6
0	-13