

## CHAPTER ONE: FUNDAMENTALS

Due Thursday, December 8

**1-A Terminology**

natural • integer • rational • real • complex • irrational • imaginary • term • expression • argument • monomial • degree • constant  
 • linear • quadratic • cubic • polynomial • binomial • trinomial • standard form • coefficient • leading coefficient

**1 Identify a number as natural, integer, rational, real, or complex.**

- 1 Sort the following numbers into the smallest set that includes each: 2, -2,  $\sqrt{2}$ ,  $\sqrt{-2}$ , -22, 2.2,  $2 - \sqrt{-2}$ ,  $2 \times 10^{22}$ ,  $2 \times 10^{-22}$ ,  $\pi$ .

**2 Identify terms and arguments.**

- 2 Identify the terms and arguments in the equation  $5x^2 - \frac{8x}{7} + 9 + 10\sqrt{x - \cos 3x}$ .

**3 Classify a polynomial in one variable.**

- 3 Write the following polynomials in standard form, and classify them.

a)  $x - 4x^3$

b)  $-15x$

c)  $8x^2 - 2x^9 + 3$

d)  $2 - 4x^2 + \frac{7x}{5} + 6x^3$

**1-B Graphs of Polynomials****1 Identify the end behavior of the graph of a polynomial.**

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

**2 Sketch a polynomial function.**

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

**1-C Properties of Exponents****1 Simplify an expression using properties of exponents.**

- 1 Simplify  $\frac{(2a^3b)^3b^6}{a^{12}b^2}$ , and write it without a fraction.

**1-D Addition, Subtraction, and Multiplication of Polynomials****1 Add or subtract polynomials.**

1  $5(4x^2 + 9x - 3) - (11x - 4)$

② Multiply two polynomials.

②  $(4x^2 - 3x)(x + 5)$

③ Expand a squared binomial.

③  $(3x + 10)^2$

④ Multiply more than two polynomials.

④  $(x + 2)(x + 5)(x - 10)$

## 1-E Factoring

factoring • common monomial

① Factor a trinomial by guessing and checking.

①  $12x^2 - 4x - 5$

② Factor a common monomial out of each term of a polynomial.

②  $40x^5 - 8x^3 + 20x^2$

③ Factor a polynomial by grouping.

③  $2x^3 - 8x^2 + 5x - 20$

④ Factor a perfect square trinomial, a difference of two squares, a difference of two cubes, or a sum of two cubes.

④ Use special cases to factor the following polynomials if possible.

a)  $x^2 - 100y^2$

b)  $x^{10} - 100y^4$

c)  $x^3 - 1000y^3$

d)  $27m^3 + 8p^3$

e)  $25x^2 - 30x + 9$

f)  $4x^2 + 10x + 25$

⑤ Factor any polynomial.

⑤  $80x^7 - 180x^5$

## 1-F Division of Polynomials

dividend • divisor

① Divide polynomials using long division.

① Divide  $2x^5 + 9x^4 + 7x^3 - 8x + 1$  by  $x^2 + 5x$ .

- 2 Finish factoring a polynomial by dividing by a known factor.  
 2 Factor  $x^3 + 6x^2 + 5x - 12$ , given that  $(x + 4)$  is a factor.

## CHAPTER TWO: FUNCTIONS

Due: Monday, December 12

### 2-A Domain and Range

relation • independent variable • dependent variable • function • vertical line test • domain • range

1 Determine whether or not a relation is a function.

- 2 Identify which of the following are functions. For those that are not, demonstrate this by giving a single value of  $x$  that results in two different values of  $y$ .

a) The parabola at right

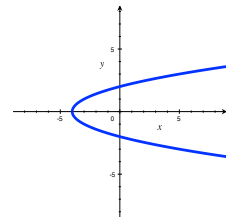
b)  $y = \pm\sqrt{x}$

c) The set of ordered pairs  $\{(3, 5), (5, 2), (3, 9)\}$

d)  $y = \sqrt{x}$

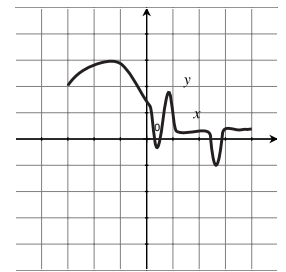
e)  $y =$  the year team  $x$  won the Superbowl

f)  $y =$  the team that won the Superbowl in year  $x$



2 Identify the domain and range of a graphed function.

- 2 Identify the domain and range of the function graphed at right.



3 Identify the domain of a function in function notation.

- 2 Identify the domain of the following functions.

a)  $a(x) = x$

b)  $b(x) = \frac{1}{x}$

c)  $c(x) = \sqrt{x}$

d)  $d(x) = \log x$

e)  $e(x) = \frac{1}{2x-8}$

f)  $f(x) = \sqrt{2x-8}$

g)  $g(x) = \log(2x-8)$

h)  $h(x) = \frac{\log(2x+7)}{3-\sqrt{20-x}}$

### 2-B Composition and Inverses

composition • inverse • one-to-one • equation • horizontal line test

1 Evaluate compositions of functions.

- 1 Given  $f(x) = 4x - 10$  and  $g(x) = x^2 + 2x - 3$ , evaluate the following.

a)  $f(g(3))$

b)  $g(f(3))$

2 Find a simplified expression for a composition of functions.

- 2 Using the functions  $f$  and  $g$ , above, give an expression for the following.

a)  $f(g(x))$

b)  $g(f(x))$

3 Identify the inverse of a basic function by definition.

3 Identify the inverse of each of the following functions, and verify that  $f^{-1}(f(x)) = x$ .

a)  $a(x) = x + 5$

b)  $b(x) = 5x$

c)  $c(x) = x^5$

d)  $d(x) = 5^x$

4 Determine whether or not two functions  $f$  and  $g$  are inverses of each other.

4 Are  $f(x) = 4x + 8$  and  $g(x) = \frac{x}{4} - 8$  inverses of each other?

5 Show proper notation in solving an equation.

5 Hans has \$900 this year and plans to save \$175 per year. In what year will he have \$1600?

6 Identify the inverse of a function conceptually.

6  $f(x) = 8x$  is the number of minutes it takes Calder to run  $x$  miles. (Miles are plugged in to calculate minutes.)

7 Find the inverse of a relation algebraically.

7 a)  $f(x) = x - 8$

b)  $g(x) = 2x + 1$

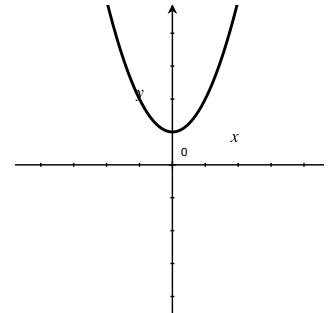
c)  $h(x) = x^2$

8 Find the inverse of a relation graphically.

8 Sketch the graph of the inverse of the parabola shown at right.

9 Determine whether or not the inverse of a graph is a function.

9 Why isn't the inverse of the function graphed at right also a function?



## 2-C Power and Root Functions

$n^{\text{th}}$  root • extraneous solution

1 Find real  $n^{\text{th}}$  roots of a number  $a$  with a calculator.

1 a) 5<sup>th</sup> roots of -50

b) 6<sup>th</sup> roots of 50

c) 6<sup>th</sup> roots of -50

2 Evaluate  $\sqrt[n]{a^m}$  or  $a^{m/n}$  by hand.

2  $8^{5/3}$

3 Solve a power equation.

3  $2(x + 5)^4 - 30 = 66$

## 2-D Exponential Functions

exponential • growth factor • decay factor • compound interest

1 Identify a scenario's rate of increase or decrease and its growth or decay factor.

1 a) 4% less

b) 200% more

c) 3 times as much

d) 3 times more

- ② Write a function for an exponential growth or decay situation, and use it to calculate future values.
- ② Annual population growth in California has been 0.88%. Given the population was 37.3 million in 2010, use this growth rate to calculate a population estimate for the following years.
- a) 2025 b) 2000

- ③ Calculate an account balance with compounded annual interest.
- ③ Heather has \$18,000 in her college fund, invested at 2.40% annual interest compounded monthly. How much will she have in 3½ years?

## 2-E Logarithmic Functions

logarithm • common log • natural log • change of base property • exponentiate • half-life

- ① Simplify the composition of a logarithmic and an exponential function.

① a)  $\log_4 4^{3x}$  b)  $3^{\log_3 2x}$  c)  $\log_2 8^x$

- ② Evaluate a simple logarithm by hand.

② a)  $\log_4 16$  b)  $\log_4 \frac{1}{16}$  c)  $\log_4 2$  d)  $\log_4 \frac{1}{2}$

e)  $\log_4 4$  f)  $\log_4 1$  g)  $\log_4 0$

- ③ Evaluate a common or natural logarithm with a calculator.

③ a)  $\log 1000$  b)  $\log .01$  c)  $\ln 20$  d)  $\log -100$

- ④ Simplify a logarithm in which the base and argument are both powers of the same base.

④  $\log_{16} 32$

- ⑤ Evaluate any logarithm.

⑤  $\log_{16} 33$

- ⑥ Solve an exponential equation.

⑥  $3(7^{2x-1}) - 30 = 360$

- ⑦ Solve a logarithmic equation.

⑦ a)  $\log_x 400 = 5$  b)  $8 \log_9 x - 2 \log_3 4x = 5$  c)  $\log (x^2 - x - 2) = 1$

- ⑧ Translate a description of a half-life situation into an equation, and solve it.

⑧ Polonium-218 has a half-life of 3.11 minutes. How long will it take 400 grams to decay to 30 grams?

- 9 Determine half-life based on decay rate or decay rate based on half-life.

9 Polonium-218 has a half-life of 3.11 minutes. What is its rate of decay?

9 Polonium-218 decays at a rate of 20.0% per minute. What is its half-life?

## 2-F Sketches of Functions

asymptote

1 Sketch any function by finding and plotting points.

2 Sketch a power function  $f(x) = x^n$ .

2 Sketch  $f(x) = x^3$ .

3 Sketch a root function  $f(x) = \sqrt[n]{a}$

3 Sketch  $f(x) = \sqrt[3]{a}$ .

4 Sketch an increasing exponential function  $f(x) = b^x$ .

5 Sketch a decreasing exponential function  $f(x) = b^x$ .

6 Sketch an increasing logarithmic function  $f(x) = \log_b x$  for  $b > 1$ .

7 Sketch a decreasing logarithmic function  $f(x) = \log_b x$ .

## 2-G Transformations

transformation • pre-image • image • translation • stretch • reflection

1 Translate a function  $h$  units right and  $k$  units up.

1 Translate the pre-image  $f(x) = 2x^2 - 5x - 4$  three units left and five units up.

2 Stretch a function horizontally by a factor of  $b$  and vertically by a factor of  $a$ .

2 Stretch the pre-image  $f(x) = 2 + \sin x$  by a factor of 2 vertically (twice as tall) and by a factor of  $\frac{1}{3}$  horizontally (one third as wide).

3 Reflect a function across the  $y$ -axis and/or the across the  $x$ -axis.

3 Reflect the pre-image  $f(x) = x^2 + 3x - 2$  across the stated axis.

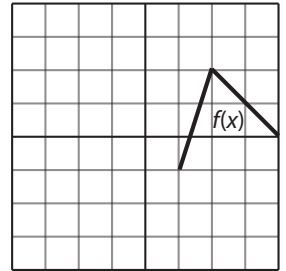
a) the  $y$ -axis

b) the  $x$ -axis

**4** Apply multiple transformations to a function.

**4** Transform the pre-image  $f(x) = x^2 - 6x + 9$  by doing the following.

- a) Reflect it across the  $x$ -axis, and then translate it up four units.      b) Translate it up four units, and then reflect it across the  $x$ -axis.



**5** Given the graph of  $f(x)$ , sketch  $f(x - h) + k$ .

**5** Given  $f(x)$  at right, graph  $f(x + 3) + 1$ .

**6** Given the graph of  $f(x)$ , sketch  $a \cdot f(x/b)$ .

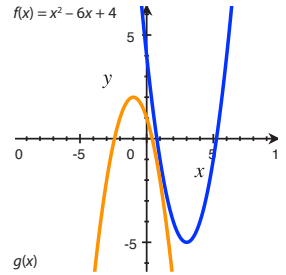
**6** Given  $f(x)$  at right, graph  $2f(2x)$ .

**7** Given the graph of  $f(x)$ , sketch  $f(-x)$  or  $-f(x)$ .

**7** Given  $f(x)$  at right, graph  $f(-x)$  and  $-f(x)$ .

**8** Use the equation of a pre-image to find the equation of a graph.

**8** Write the equation for  $g(x)$  graphed at right.



**CHAPTER THREE: QUADRATICS**

**Due Wednesday, December 14**

**3-A Graphs of Quadratic Functions**

standard form • vertex form • vertex • axis of symmetry • maximum • minimum

**1** Identify the vertex of a quadratic in vertex form.

**1** a)  $y = \frac{1}{8}(x - 2)^2 + 3$

b)  $y = \frac{1}{8}(x + 2)^2 - 3$

**2** Write a quadratic equation in standard form.

**2**  $2x^2 = 3(x + 5)^2 + 100$

**3** Find the vertex of a parabola in standard form.

**2**  $f(x) = 2x^2 - 10x + 7$

**4** Find the vertex of a parabola in intercept form.

**4**  $f(x) = \frac{1}{5}(x - 4)(x + 6)$

**5** Sketch a parabola and its axis of symmetry.

**5**  $y = \frac{-1}{6}(x + 2)^2 + 5$

**3-B Simplifying Radical Expressions**

radicand • radical

**1** Simplify a square root.

**1**  $\sqrt{75x^2y^6z^2}$

2 Simplify an  $n^{\text{th}}$  root.

2  $\sqrt[3]{800x^3y^6z^8}$

3 Reduce a rational expression.

3  $\frac{6x^2 - 14x\sqrt{6x}}{8x^4 + 24x^3}$

4 Rationalize a denominator with one or two terms.

a)  $\frac{12}{\sqrt{20}}$

b)  $\frac{12}{8 - \sqrt{20}}$

### 3-C Complex Numbers

imaginary number • complex number • complex plane • complex conjugate

1 Write a fractional complex number in standard form.

2 Write  $\frac{-10 + 14i}{9}$  in standard form.

2 Plot numbers on the complex plane.

a)  $5 - 2i$

b)  $-2$

c)  $4i$

d)  $\frac{-15 + 11i}{2}$

3 Solve equations with complex solutions.

3  $2x^2 + 91 = 3$

4 Add, subtract, and multiply complex numbers.

a)  $(5 + 2i) - (8 - 3i)$

b)  $(5 + 2i)(8 - 3i)$

5 Divide complex numbers.

5  $\frac{3 + 4i}{2 - 10i}$

### 3-D Solving Quadratic Equations

completing the square • quadratic formula • solution • zero • root • x-intercept

1 Solve a quadratic equation by factoring.

1  $18x^3 = 50x$



2 Solve a quadratic equation by isolating a square.

2  $8(2x + 3)^2 - 80 = 120$

3 Solve a quadratic equation by completing the square.

3  $2x^2 + 20x + 34 = 16$

4 Solve a quadratic equation with the quadratic formula.

4  $12x^2 + 17x = 7$

5 Solve any quadratic equation.

5  $x^2 + 10x + 30 = 9$

6 Find the solutions, zeros, roots, or x-intercepts of a quadratic.

6 The solutions to  $x^2 + 10x + 21 = 0$  are \_\_\_\_\_. The zeros or roots of  $f(x) = x^2 + 10x + 21$  are \_\_\_\_\_.  
The x-intercepts of  $f(x) = x^2 + 10x + 21$  are \_\_\_\_\_.

### 3-E Conic Sections

conic section • ellipse • circle • hyperbola • asymptote

1 Sketch an ellipse given in standard form.

1  $\frac{(x-2)^2}{9} + \frac{(y+1)^2}{25} = 1$

2 Sketch a hyperbola given in standard form.

2  $\frac{(x-2)^2}{9} - \frac{(y+1)^2}{25} = 1$

3 Identify ellipses and hyperbolas.

3 a)  $5x^2 + 5y^2 + 8x - 3y = 12$

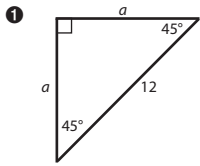
b)  $\frac{(y+8)^2}{4} - \frac{3(x+1)^2}{10} = 1$

4 Write in standard form the equation of an ellipse or hyperbola written as a polynomial.

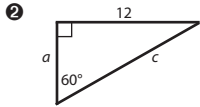
4  $x^2 + 4y^2 + 10x - 24y + 45 = 0$

**4-A Special Right Triangles**

1 Find unknown lengths in a 45° right triangle.



2 Find unknown lengths in a 30° right triangle.



3 Solve problems by identifying 30° right triangles or 45° right triangles.

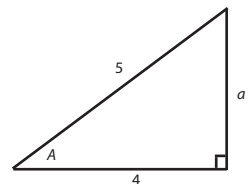
3 What is the area of a square with a diagonal of 6?

**4-B Trigonometric Functions in Right Triangles**

trigonometric function • sine • cosine • tangent • cosecant • secant • cotangent

1 Find the values of each of the six trigonometric functions of a nonright angle in a right triangle with two known sides.

1 Find the sine, cosine, tangent, cosecant, secant, and cotangent of angle A shown at right.

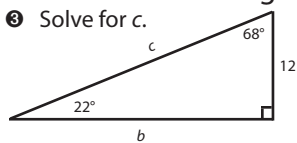


2 Find values of cotangent, secant, and cosecant on the calculator.

2 Evaluate  $\sec 25^\circ$ .

3 Calculate a side length in a right triangle based on a known angle and known side length.

3 Solve for c.

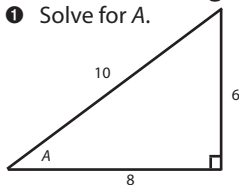


**4-C Inverse Trigonometric Functions in Right Triangles**

inverse trigonometric function •  $\sin^{-1}$  (arcsin) •  $\cos^{-1}$  (arccos) •  $\tan^{-1}$  (arctan)

1 Calculate an angle measure in a right triangle based on two known side lengths.

1 Solve for A.



2 Solve a right triangle.

