KMHS Mathematics Department

Algebra 2

Chapter 1

Polynomials

Adding and Subtracting with Polynomials

- Adding
  $(2x^2 + 3x + 1) + (x^2 + 2x - 2)$

Step 1: If no numbers can be combined in the parenthesis distribute 1 into each and remove the parenthesis:

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

Step 2: Add or Subtract like terms

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

$$\mathbf{3x^2 + 5x - 1}$$

- Subtracting
  $(2x^2 + 3x + 1) - (x^2 + 2x - 2)$

Step 1: If no numbers can be combined in the parenthesis distribute 1 into each and remove the parenthesis. *When you distribute the 1 into the 2nd set of parenthesis the subtraction sign goes with it and changes the sign of the numbers:

$$2x^2 + 3x + 1 \mathbf{- x^2 - 2x + 2}$$

Step 2: Add or Subtract like terms

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

$$\mathbf{x^2 + x + 3}$$

Section 2

Multiplying with Polynomials

- Multiplying : $(2x \quad - 3y)(x \quad + y)$

Step 1: Distribute 1st number into the 2nd set parenthesis then Distribute the 2nd number into the 2nd set parenthesis

$2x^2 + 2xy - 3xy \ - 3y^2$

Step 2: Add or Subtract like terms

$2x^2 + 2xy - \ 3xy \ - 3y^2$

$\mathbf{2x^2 - xy \ - 3y^2}$

Section 3

Simplifying Algebraic Expressions

Follow the order of operations to solve:

PEMDAS

Parenthesis

Exponents

Multiplying Dividing

Addition Subtraction

Section 4

Dividing with Polynomials

Division: Divide whole numbers by whole numbers, and subtract exponents of like variables.

$10x^2y^2$+20xy by 5xy

Answer: 2xy + 4

Chapter 2

Factoring

Factoring by Greatest Common Factor

Factoring by
Greatest Common Factor

Process: Factor out the greatest common factor that all parts have. For this problem 10xy gets factor out. Place a 1 in the 2nd space to hold the place.

Question: $20x^2y^2+10xy$

Answer: 10xy(2xy + 1)

Factoring by Difference of Two Perfect Squares

Factoring by
Difference(-) of Two Perfect Square

Question: x^2 - $16y^2$

Process: Step #1 Take the square root of the first and second term.

Answer: x , 4y

Step#2 Put the square first and second term in 2 sets of parenthesis. One set will have a plus sign in between one set will have a minus sign in between.

Question: x^2 - $16y^2$

Final Answer: (x - 4y)(x + 4y)

Factoring by Grouping

Factoring by Grouping

Question:

$ab+2a+3b+6$

Process: Step #1 Take the square root of the first and second term.

Answer: x , 4y

Step#2 Put the square first and second term in 2 sets of parenthesis. One set will have a plus sign in between one set will have a minus sign in between.

Question: x^2 - $16y^2$

Final Answer: (x - 4y)(x + 4y)

Factoring Trinomials

Factoring Trinomials

Example #1: $x^2 + 9x + 18$

Process: Step #1 Place the square root of 1st term in two different parenthesis:

Answer: (x)(x)

Step#2 Put two numbers that multiply to give you the last number and adds up to the middle term. *The rules for positive and negative numbers being added and multiplied apply:

Final Answer: (x + 6)(x + 3)

Example #2: $x^2 - 11x + 18$

Answer: (x - 9)(x – 2)

Example #3: $x^2 - 7x - 18$

Answer: (x - 9)(x + 2)

Example #4: $x^2 + 7x - 18$

Answer: (x + 9)(x - 2)

Eyeglasses/Decomposition

Example: $7x^2 + 3x - 10$
Step 1: Multiply the first and the last number:
-70

Step 2: Find two #s that multiply to equal this new # (**-70**) and adds up to the middle #(**3x**):
-7, 10

Step 3: Attach a variable(**x**) to the two new #s(**-7, 10**),
and replace the middle # (**3x**):
$7x^2 - 7x + 10x - 10$

Step 4: Separate with parenthesis

$(7x^2 - 7x) + (10x - 10)$

Step 5: Factor out the greatest common factor from the first set and second set make the sets of parenthesis look the same.
$7x(x - 1) + 10(x - 1)$

Step 6: Place the # factored out in their own parenthesis.
Final Answer: $(7x + 10)(x - 1)$

Section 6

Factor Completely

Example: $2x^2 - 32$
Step 1: Factor **$2(x^2 - 16)$**

Step 2: Factor Again
$2(x - 4)(x + 4)$

Step 3: Once you have nothing left to factor the problem is done
$2(x - 4)(x + 4)$

Chapter 3

Rational Expressions

Section 1

Rational Expressions

Undefined: when a fractions denominator equals zero it is undefined

$\frac{4}{x}$ when x is 0 this is undefined

$\frac{4}{x-1}$ when x is 1 this is undefined

$\frac{7}{x^2-4}$ when x is 2 or -2 this is undefined

Section 2

Reducing Rational Expressions

$\frac{4xy}{8x}$ cancel or reduce like terms to reduce to y/2

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

Step #1 Factor first

$$\frac{x+2}{(x-2)(x+2)}$$

Step #2 Then Cancel or Reduce any like terms

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

Multiplying and Dividing Rational Expressions

Multiplying

$\frac{x+2}{x^2-4} * \frac{(x+3)(x+2)}{x^2+5x+6}$

Step #1 Factor first

$\frac{x+2}{(x-2)(x+2)} * \frac{(x+3)(x+2)}{(x+3)(x+2)}$

Step #2 Then Cancel or Reduce any like terms either vertically or Diagonal

$\frac{1}{x-2} * 1$

Step # 3 Multiply and if necessary reduce your final answer

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

Dividing

$\frac{x+2}{x^2-4} \div \frac{x^2+5x+6}{(x+3)(x+2)}$

First flip the second fraction & change the division sign to a multiplying sign. Then follow the same process as multiplication

Step #1 Factor first $\frac{x+2}{(x-2)(x+2)} * \frac{(x+3)(x+2)}{(x+3)(x+2)}$

Step #2 Then Cancel or Reduce any like terms either vertically or Diagonal

$\frac{1}{x-2} * 1$

Step # 3 Multiply and if necessary reduce your final answer

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

Section 4

Complex Fractions

- $$\frac{x-8+\frac{7}{x}}{x-12+\frac{35}{x}}$$

Step #1 Multiply all parts of the fraction by the LCD (x in this case) of the smaller fractions

$$\frac{x^2-8x+7}{x^2-12x+35}$$

Step #2 Factor $\frac{(x-7)(x-1)}{(x-7)(x-5)}$

Step #3 Then Cancel or Reduce any like terms either vertically

$$\frac{x-1}{x-5}$$

Adding or Subtracting Rational Expressions

-

Step #1 If you have a common Denominator Add or Subtract Like terms in the numerator

$$\frac{2x^2-6x+4}{x^2-12x+35}+\frac{-x^2-2x+3}{x^2-12x+35}$$

Step #2 If necessary factor

$$\frac{x^2-8x+7}{x^2-12x+35}=\frac{(x-7)(x-1)}{(x-7)(x-5)}$$

Step #3 Then Cancel or Reduce any like terms either vertically

$$\frac{x-1}{x-5}$$

Chapter 4

Functions

Section 1

Function Notation

h (***x***) = ***x***+**1** , find:

h(4)

Step #1 plug the value in the parenthesis in for x in the problem

h (4) = 4+**1**

Step #2 Simplify the problem

h (4) = 5

Composition of Functions

f **(*x*)** = ***x*** - **6** and ***g*** **(*x*)** = x + 1 find:

f ∘ g (4)

Step #1 plug the value in the parenthesis in to the functions closest to it g (4) = 4+**1**

Step #2 Plug the answer from Step #1 into the next function

g (4) = 5

f(5)= 5-6 = -1

Step#3 When you are out of functions you are at your final answer

f ∘ g (4) = -1

Section 3

Inverse Functions

Creating a Inverse Function

$\boldsymbol{f(x) = x - 6}$

Step #1 X and f(x) switch places: $x = f(x) - 6$

Step #2 Solve for f(x):

$X + 6 = f(x)$

Step#3 Move the f(x) to the left side of the function and attach a negative 1 onto it in the exponent area:

$f^{-1}(x)=x+6$

Graph of a Function

A graph of a function presents the answers of a function in a graph form

Vertical Line Test: if you can draw a vertical line that crosses the graph of a function in more then one place it is not a function

Chapter 5

Radicals

Perfect Squares

- $$\sqrt{64\ x^{30}}$$

  Take the square root(number times itself) of the number and half the exponent. $8x^{15}$

- $$\sqrt[3]{64\,x^{30}}$$

  Take the cube root(number times itself three times) of the number and 1/3of the exponent. $4x^{10}$

Simplyfing Radicals

- $$\sqrt{128x^{31}}$$

If the number is not a perfect square break the number down into a perfect square and a non-perfect square number that has no perfect square within it some examples of this are: 2, 3, 5, 7, 10, 11, 14, 15 if you have a variable does not have a even number take one away from it:

$$\sqrt{64 \ * 2\,x * x^{30}}$$

Take the square root(number times itself) of the number and half the exponent. $8x^{15}\sqrt{128x^{1}}$

- $$\sqrt[3]{128x^{31}}$$

If the number is not a perfect cube root break the number down into a perfect cube for example 8, 27, 64, 125 and a non-perfect cube number. If your variable is not divisible by three break down to the largest number that is divisible by 3 and another number that is not divisible by 3:

$$\sqrt[3]{64 \ * 2\,x * x^{30}}$$

Take the cube root(number times itself three times) of the number and 1/3of the exponent. $4x^{10}\ \sqrt[3]{2x^{1}}$

Section 3

Adding and Subtracting Radicals

- $8\sqrt{14x} + 7\sqrt{14x}$

  What is underneath the radical must be the same in order to add or subtract the exterior numbers. You may be able to simplify what is underneath the radical in order to make the numbers match.

  $8\sqrt{14x} + 7\sqrt{14x} = 15\sqrt{14x}$

Section 4

Multiplying Radicals

- $3\sqrt{2x} * 2\sqrt{8x}$

Step #1 What is underneath the radical gets multiplied by what's underneath the radical. What is outside the radical gets multiplied what is outside the radical.

$3\sqrt{2x} * 2\sqrt{8x} = 6\sqrt{16x^2}$

Step#2 Simplify your final answer.

$6\sqrt{16x^2}$ = 24x

Section 5

Dividing Radicals

- $4\sqrt{8x} \div 2\sqrt{2x}$

Step #1 What is underneath the radical gets divide by what's underneath the radical. What is outside the radical gets divided by what is outside the radical.

$4\sqrt{8x} \div 2\sqrt{2x} = 2\sqrt{4}$

Step#2 Simplify your final answer.

$2\sqrt{4} = 4$

Section 6

Rationalizing a Denominator

- $\frac{4}{\sqrt{2}}$

Step #1 Multiply the numerator & the denominator of the fraction by what is under the radical in the denominator.

$$\frac{4}{\sqrt{2}} \text{ x } \frac{\sqrt{2}}{\sqrt{2}} = \frac{4\sqrt{2}}{2}$$

Step#2 Simplify your final answer.

$2\sqrt{2}$

Rationalizing a Binomial Denominator

- $$\frac{4}{1+\sqrt{2}}$$

Step #1 Multiply the numerator & the denominator of the fraction by the conjugate of the denominator is under the radical in the denominator.

$$\frac{4}{1+\sqrt{2}} \text{ x } \frac{1-\sqrt{2}}{1-\sqrt{2}} = \frac{4(1-\sqrt{2})}{1-2}$$

Step#2 Simplify your final answer.

$-4(1-\sqrt{2})$

Radical Equations

- $\sqrt{2x} + 4 = 6$

Step#1 get the radical by itself

$\sqrt{2x}$ =2

Step#2 Square both sides to get rid of the radical by itself

2x = 4

Step#3 Solve for x

x = 2

Chapter 6

Imaginary Numbers

Pure Imaginary

- *For problems #1-16*

  Negatives Under a radical gets changed

  $\sqrt{-64} = \sqrt{64i^2}$

  Then follow the normal rules for square root equations

  $\sqrt{64i^2} = 8i$

#17-24

- For all imaginary questions the answers will be one of the 4 following answers. If a number exceeds an exponent of 3 divide by 4 and the answer is equivalent to your remainder:
- $i^0 = 1$
- $i^1 = i$
- $i^2 = -1$
- $i^3 = -i$
-
- Example 1: $i^{400} = i^0 = 1$
- Example 2: $i^{81} = i^1 = i$
- Example 3: $i^{102} = i^2 = -1$
- Example 4: $i^{403} = i^3 = -i$

Adding or Subtracting Imaginary Numbers

- Step#1 Simplify the problem by removing any i or perfect squares from underneath the radical

Step #2 Follow the rules for Adding or Subtracting numbers with variables and radicals.

$\sqrt{-4} + \sqrt{-16}$

$\sqrt{4i^2} + \sqrt{16i^2}$

2i + 4i = 6i

Complex Number Sheet

- Step#1 Simplify the problem by removing any i or perfect squares from underneath the radical

  Step #2 Follow the rules for Adding or Subtracting numbers with variables and radicals.

  $$\sqrt{-4} + \sqrt{-16}$$

  $$\sqrt{4i^2} + \sqrt{16i^2}$$

  $$2i + 4i = 6i$$

- $$\frac{5}{1+2i}$$

  Step #1 Multiply the numerator & the denominator of the fraction by the conjugate of the denominator.

  $$\frac{5}{1+\sqrt{2}} \text{ x } \frac{1-2i}{1-2i} = \frac{5(1-2i)}{1+4}$$

  Step#2 Simplify your final answer.

  1-2i)

Chapter 7

Quadratics

Solving Quadratics by Factoring

Solving by Factoring

Greatest Common Factor

Process: Factor out the greatest common factor. Set both factors equal to zero and solve for x.

Question: $20x^2 + 10x = 0$

Answer: 10x (2x + 1)

10x = 0 2x +1 = 0

x = 0 **x = -1/2**

Difference(-) of Two Perfect Square

Question: x^2 - 16 = 0

Process: Step #1 Take the square root of the first and second term. Answer: x , 4

Step#2 Put the square first and second term in 2 sets of parenthesis. One set will have a plus sign in between one set will have a minus sign in between.

Question: x^2 - 16 = 0

Final Answer: (x - 4)(x + 4) = 0

Step #3 Set each factor equal to zero and solve for x

x-4 = 0 x + 4 = 0

x =4 x = -4

Factoring Trinomials

Example #1: $x^2 + 9x + 18 = 0$

Process: Step #1 Place the square root of 1st term in two different parenthesis:

Answer: (x)(x)

Step#2 Put two numbers that multiply to give you the last number and adds up to the middle term. *The rules for positive and negative numbers being added and multiplied apply:

Final Answer: (x + 6)(x + 3)=0

- Step#3 Set your factors equal to zero and solve for x
- x + 6 = 0 x + 3 = 0
- X = -6 x = -3

Solving Quadratics by the Quadratic Formula

Example : x^2 - 6x + 3=0 if problem is un-factorable us
The quadratic formula to solve it.

Process: Step #1 take the numbers and signs in front of x^2 - 6x + 3=0 make them a = **1** b = **-6** c = **3**

Step#2 Plug those numbers in for a, b, and c into the quadratic formula and simplify the problem:

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

- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
-
- $x = \frac{--6 \pm \sqrt{(-6)^2 - 4(1)(3)}}{2(1)}$
- $x = \frac{6 \pm \sqrt{36-12}}{2}$
- $x = \frac{6 \pm \sqrt{24}}{2}$
- $x = \frac{6 \pm 2\sqrt{6}}{2}$
- $x = \frac{2(3 \pm \sqrt{6})}{2}$
-
-
- $x = 3+\sqrt{6}$ $x = 3-\sqrt{6}$

Discriminant Solving Quadratics by the Quadratic Formula

$b^2 - 4ac$

The Discriminant is the part that is under the radical in the quadratic formula. For the number you get needs for your answer the following three questions about the roots(answers) of your equation.

Question#1: Is the number positive or negative?

If your answer is positive then it is: **REAL**

If your answer is negative then it is: **IMAGINARY**

Question#2: Is the number a perfect square?

If your answer is a perfect square then it is: **Rational**

If your answer is not a perfect square it is: **Irrational**

Question#3: Is the number zero?

If your answer is a zero then your roots are: **EQUAL**

If your answer is a nonzero then your roots are: **UNEQUAL**

Example#1: $x^2 - 6x + 3=0$ Process: Step #1 take the numbers and signs in front of $x^2 - 6x + 3=0$ make them **a = 1 b = -6 c = 3**

Step#2 Plug those numbers in for a, b, and c into the discriminant, simplify the problem and answer the 3 questions:

- Example#1
- $x^2 - 6x + 3=0$
- $b^2 - 4ac$
- $(-6)^2 - 4(1)(3) = 24$
- 1)real, 2) irrational 3) unequal
-
- Example #2
- $x^2 - x - 6=0$
- $b^2 - 4ac$
- $(-1)^2 - 4(1)(-6) = 25$
- 1)real, 2) rational 3) unequal
-
- Example #3
- $3x^2 - 6x + 3=0$
- $b^2 - 4ac$
- $(-6)^2 - 4(3)(3) = 0$
- 1)real, 2) rational 3) equal
-
- Example #4
- $x^2 - 2x + 3=0$
- $b^2 - 4ac$
- $(-2)^2 - 4(1)(3) = -8$
- 1) imaginary

Sum of the Roots and Product of the Roots

- Example#1: x^2 - 6x + 3=0
  Process: Step #1 take the numbers and signs in front of x^2 - 6x + 3=0 make them **a = 1 b = -6 c = 3**

  Step#2 Plug those numbers in for a, b, and c and simplify

  Sum of the Roots r1 + r2 = -b/a = - -6/1 = 6

  Product of the Roots (r1)(r2) = c/a = 3/1 = 3

Writing a Quadratic When the Roots Are Given

- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- Step #1 Plug in the roots into the equation above
- Step#2 Simplify the equation
- *If any fractions remain in you r final answer multiply the entire problem by the LCD(Least Common Denominator)

- Example#1
- $r_1 = 3 \quad r_2 = -1$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (3 + -1)x + (3)(-1) = 0$
- $\boldsymbol{x^2 - 2x - 3 = 0}$

- Example#2
- $r_1 = 1/3 \quad r_2 = 2/3$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (1/3 + 2/3)x + (1/3)(2/3) = 0$
- $x^2 - (3/3)x + (2/9) = 0$
- multiply everything by 9 the LCD to cancel out all the fractions
- $\boldsymbol{9x^2 - 9x + 2 = 0}$

- Example#3
- $r_1 = 1 + \sqrt{2} \quad r_2 = 1 - \sqrt{2}$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (1 + \sqrt{2} + 1 - \sqrt{2})x + (1 + \sqrt{2})(1 - \sqrt{2}) = 0$
- $x^2 - (2)x + (1 - 2) = 0$
- $\boldsymbol{x^2 - 2x - 1 = 0}$

- Example#4
- $r_1 = 2 - i \quad r_2 = 2 + i$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (2 - i + 2 + i)x + (2 - i)(2 + i) = 0$
- $x^2 - (4)x + (4 - i^2) = 0$
- $x^2 - (4)x + (4 - -1) = 0$
- $\boldsymbol{x^2 - 4x + 5 = 0}$

Section 6

Solving 2 Variable Equations with Add/Subtract Method

Step #1 Get the same number opposite sign in front of one of your variables.

Step#2 Add your 2 equations together: this will cancel out one of our variables.

Step #3 Solve for your remaining Variable.

Step #4 Plug in your answer from Step#3 into one of the original equations and solve for the other variable

Step #5 Check

Section 7

Solving 2 Variable Equations with Substitution Method

Step #1 Get one variable by itself

Step#2 Plug on equation into the other equation.

Step #3 Solve for your remaining Variable.

Step #4 Plug in your answer from Step#3 into one of the original equations and solve for the other variable

Step #5 Check

Section 8

Solving 2 Variable Equations with Add/Subtract Method

Step #1 Get one variable by itself

Step#2 Plug one equation into the other equation.

Step #3 Solve for your remaining Variable through factoring, solving for it, or quadratic formula.

Step #4 Plug in your answer from Step#3 into one of the original equations and solve for the other variable you should get two pairs of answers

Step #5 Check

Section 9

Solving 2 Var Quad System of Equations with Add/Subtract

Step #1 Get the same number opposite sign in front of one of your variables.

Step#2 Add your 2 equations together: this will cancel out one of our variables.

Step #3 Solve for your remaining Variable you will get two answers.

Step #4 Plug in your answer from Step#3 into one of the original equations and solve for the other variable you will get two more answers.

Step #5 Check

Solving a 3 by 3 System of Equation

Step #1 Label your 3 equations A, B, and C

Step#2 Pick 2 equations and cancel out one of the variables and Label the new equation D

Step #3 Pick 2 different original equations and cancel out the same variable is in step #2 and Label the new equation E

Step #4 Use either addition & subtraction method or substitution method to solve for the remaining 2 variables in D, E

Step#5 Plug in the two answers you found in Step #4 into one of the original equations (A, B, or C) and solve for the 3rd and final variable

Step #6 Check

Chapter 8

Absolute Value and Rational Expression

Absolute Value Equations

- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- Step #1 Plug in the roots into the equation above
- Step#2 Simplify the equation
- *If any fractions remain in you r final answer multiply the entire problem by the LCD(Least Common Denominator)

- Example#1
- $r_1 = 3 \quad r_2 = -1$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (3 + -1)x + (3)(-1) = 0$
- $\mathbf{x^2 - 2x - 3 = 0}$

- Example#2
- $r_1 = 1/3 \quad r_2 = 2/3$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (1/3 + 2/3)x + (1/3)(2/3) = 0$
- $x^2 - (3/3)x + (2/9) = 0$
- multiply everything by 9 the LCD to cancel out all the fractions
- $\mathbf{9x^2 - 9x + 2 = 0}$

- Example#3
- $r_1 = 1 + \sqrt{2} \quad r_2 = 1 - \sqrt{2}$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (1 + \sqrt{2} + 1 - \sqrt{2})x + (1 + \sqrt{2})(1 - \sqrt{2}) = 0$
- $x^2 - (2)x + (1 - 2) = 0$
- $\mathbf{x^2 - 2x - 1 = 0}$

- Example#4
- $r_1 = 2 - i \quad r_2 = 2 + i$
- $x^2 - (r_1 + r_2)x + r_1r_2 = 0$
- $x^2 - (2 - i + 2 + i)x + (2 - i)(2 + i) = 0$
- $x^2 - (4)x + (4 - i^2) = 0$
- $x^2 - (4)x + (4 - -1) = 0$
- $\mathbf{x^2 - 4x + 5 = 0}$

Absolute Value Inequalities

- **<u>Absolute Value Inequalities</u>**
- $|2x+4| - 3 < 11$
- Step#1 Move all numbers outside of the absolute value signs to the other side of the equal sign
- $|2x + 4| < 14$
- Step #2 Remove absolute value signs flip the sign on the negative equation. Solve the equation twice once with the answer positive once with the answer negative
- $2x < 10$ $\qquad$ $2x > -18$
- **$x < 5$** $\qquad$ **$x > -9$**

Solving Rational Equations

- $\frac{2}{x^2-1} - \frac{x}{x-1} = \frac{2}{x+1}$
- Step #1 Find LCD and Multiply all parts of the problem by the LCD to cancel out the fractions: **(x+1)(x-1)**
- $\frac{2}{(x \quad -1)(x+1)} - \frac{x}{x-1} = \frac{2}{x+1}$
- Step #2 Simplify:
- $2 - x^2 - x = 2x - 2$
- $x^2 + 3x - 4 = 0$
- Step #3 Solve for x you may have to factor
- $(x + 4)(x - 1) = 0$
- **x=-4 x = 1**
- Step#4 Check your answers to make sure they work
- **x=-4 Works**
- **x = 1 Doesn't work because it makes the problem undefined**

Solving Rational Inequalities

- $\frac{2}{x^2-1} - \frac{x}{x-1} > \frac{2}{x+1}$
-
- Step #1 Find LCD and Multiply all parts of the problem by the LCD to cancel out the fractions: **(x+1)(x-1)**
- $\frac{2}{(x\ \ -1)(x+1)} - \frac{x}{x-1} > \frac{2}{x+1}$
-
- Step #2 Simplify:
-
- $2 - x^2 - x > 2x - 2$
-
- $x^2 + 3x - 4 > 0$
-
- Step #3 Solve for x you may have to factor
- $(x + 4)(x - 1) > 0$
- **x > -4   x < 1**
-
- Step#4 Check your answers to make sure they work
- **x > -4   Works**
- **x < 1 Doesn't work because it makes the problem undefined**

Chapter 9

Exponents

Laws of Exponents

Multiplying: Add exponents

$x^2 * x^3 = x^5$

Dividing: Subtract Exponents

$x^5/x^3 = x^2$

Parenthesis: Multiply Exponents

$(x^5)^3 = x^{15}$

Section 2

Zero and Negative Exponents

Zero Exponents change the number to 1:

$4x^0 = 4(1) = 4$

Negative Exponents move under a fraction to become positive:

$X^{-3} = {}^1/x^3$

Fractional Exponents

- Fractional Exponents bottom number is the power of the Radical and Top is the power of the number and then simplify:
- $8^{2/3} = \sqrt[3]{8^2} = 4$
- Multiplying: Add exponents
- $X^{2/5} * x^{3/5} = x^1$
-
- Dividing: Subtract Exponents
- $X^{2/3}/x^{1/3} = x^{1/3}$
-

Solving Equations with Fractional Exponents

- Step #1 Move all numbers away from the variable:
- $x^{2/3} - 4 = 4$
- $x^{2/3} = 8$

- Step #2 Multiply by the reciprocal of the fractional Exponent on both sides and then simplify:
- $X^{2/3 * 3/2} = 8^{3/2}$
- $x = \sqrt[3]{8^2} = 4$

Section 5

Solving Exponential Equations

- Step #1 Move all numbers away from the variable and it's exponents $2^{2x-1} + 4 = 12$
- $2^{2x-1} = 8$
- Step #2 Get a common base :
- $2^{2x-1} = 2^3$
- Step #3 Remove the exponents from the base and solve for x
- $2x-1 = 3$
- $X = 2$

Chapter 10

Statistics

Section 1

Measure of Central Tendency

Mean – the average of your numbers

Range-difference between the largest and the smallest number

Median-middle number of all your data

Mode-Number that appears the most often

Quartile #1(Q#1-lower quartile)- Median of the smaller numbers

Quartile #3(Q#3-upper quartile)-Median of the larger numbers

Box and Whisker plot – Graph on a number line Q#1 Med Q#3 make a box smallest and largest # make the whiskers

Measure of Central Tendency Frequency Chart

xi = represents the data

fi = represents the frequency or number of times each piece of data appears

Section 3

Variance and Standard Deviation

$$SD = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

x = represents the data

x with the line over it= mean

n = number of data

Σ = sum of the data

SD = Standard Deviation

Section 4

Percentile

xi	fi
16	6
17	4
19	8
22	3

What Percentile is 19 in?

Step#1 A) Add up the total frequency column: 6 + 4 +8 + 3 = 21(This is the Denominator)

B) Add up the Frequency of the #s that 19 is larger then and half of the frequency of 19(This total becomes our Numerator): 6 + 4 +8/2 = 14

Step# 2 A) Make a fraction out of the two #s in step #1 14/21

B) change this to a decimal 0.67

C) Move the decimal point 2 places to the right the final answer is 19 is in the 67th percentile

Chapter 11

Probability

Section 1

Counting Principal

Choosing a lunch of sandwich, drink, and dessert from 5 sandwiches, 6 drinks, and 3 desserts?

In the Counting Principal Multiply all your options together to get your total number of choices: 5 x 6 x 3 = 90 Possible options

Section 2

Combination & Permutation

Combination – order doesn't matter. Example: We have 5 students in the math fair. How many ways can 3 honorable mention be awarded?

${}_{n}C_{r} = {}_{5}C_{3} = 10$

Permutation – order does matter. Example: We have 5 students in the math fair. How many ways can 1st, 2nd and 3rd place be awarded?

${}_{n}P_{r} = {}_{5}P_{3} = 60$

Section 3

Probability

Probability of an Event P(E) = Event/Total Number of Outcomes

*or Event: What is the Probability that you pick a Queen or a King out of a deck of cards?

P(Queen or King) = 4/52 + 4/52 = 8/52 = 2/13

*and Event: What is the Probability that you pick a Queen replace it then a King out of a deck of cards?

P(Queen and King) = 4/52 * 4/52 = 1/169

Section 4

Probability with Two Outcomes

If you flip a coin 3 times what is the probability of getting Exactly 2 tails. Use the following Probability formula

$_nC_r\ p^r q^{n-r}$

n = number of coins flipped(3)

r=number of times you want the coin to Land on Tails (2)

p= probability of landing on tails if you flipped the coin once (1/2)

q= probability of it not landing on tails if you flipped the coin once (1/2)

$_3C_2\ (1/2)^2(1/2)^{3-2} = 3/8$

Probability with Two Outcomes: At Least/At Most

At Least

If you flip a coin 3 times what is the probability of getting at least 2 tails. Use the following Probability formula

${}_nC_r\ p^rq^{n-r}$

n = number of coins flipped(3)

r=number of times you want the coin to Land on Tails (2 and 3)

p= probability of landing on tails if you flipped the coin once (1/2)

q= probability of it not landing on tails if you flipped the coin once (1/2)

${}_3C_2\ (1/2)^2(1/2)^{3-2} = 3/8$

${}_3C_3\ (1/2)^3(1/2)^{3-3} = 1/8$

Then add your answers 3/8 + 1/8 = 4/8 = **1/2**

At Most

- If you flip a coin 3 times what is the probability of getting at most 1 tails. Use the following Probability formula
- ${}_nC_r\ p^rq^{n-r}$
- n = number of coins flipped(3)
- r=number of times you want the coin to Land on Tails (1 and 0)
- p= probability of landing on tails if you flipped the coin once (1/2)
- q= probability of it not landing on tails if you flipped the coin once (1/2)
- ${}_3C_1\ (1/2)^1(1/2)^{3-1} = 3/8$
- ${}_3C_0\ (1/2)^0(1/2)^{3-0} = 1/8$
- Then add your answers 3/8 + 1/8 = 4/8 = **1/2**

Binomial Expansion

$(x + y)^3$

Step#1 Create Pascal's Triangle to Create the Coefficients of Your Answer

Step#2 The X term starts with the exponent 3 and counts down to zero

Step #3 The Y term starts with the exponent 0 and counts up to 3

Step #4 Simplify your answer

1
1 1
1 2 1
1 3 3 1

$1x^3y^0 + 3x^2y^1 + 3x^1y^2 + 1x^0y^3$

Final Answer:

$\mathbf{x^3 + 3x^2y + 3xy^2 + y^3}$

Finding a Single Term

$(x + y)^3$ Find the 2nd term

Use the following formula: ${}_nC_{r-1}\ A^{n-r+1}\ B^{r-1}$

n = 3(exponent of the problem

r = 2 (2nd term)

A = x

B = y

Step#1 Plug all the values into the formula

Step#2 Simplify

${}_nC_{r-1}\ A^{n-r+1}\ B^{r-1}$

${}_3C_{2-1}\ x^{3-2+1}\ y^{2-1}$

Final Answer:

$3x^2y$

Chapter 12

Sequences

Sequences

2, 4, 6, 8, 10, 12, 14 .....

Arithmetic Sequence – has a common difference(same # being added over and over). Common Difference $d = 2$

2, 4, 8, 16, 32, 64, 128 .....

Geometric Sequence – has a common multiple(same # being multiplied over and over). Common Multiple $r = 2$

Section 2

Arithmetic Sequences

2, 4, 6…

Find the 10th term

Use the following formula: $a_n = a_1 + (n - 1)d$

n = Answer # you are looking for

d = sum of all the answers in your sequence

a_1 = first term of your sequence

a_n = Answer you are looking for

Step#1 Plug all the values into the formula

Step#2 Simplify

$a_n = a_1 + (n - 1)d$

$a_{10} = a_1 + (n - 1)d$

$a_{10} = 2 + (10 - 1)2$

$a_{10} = 2 + (9)2$

$a_{10} = 2 + (18)$

$\mathbf{a_{10} = 20}$

Geometric Sequences

2, 4, 8, 16, 32, 64, 128 ….

Find the 10th term

Use the following formula: $a_n = a_1 r^{n-1}$

n = number in the sequence you are looking for

r = common multiple

a_1 = first term of your sequence

a_n = which answer are you looking for

Step#1 Plug all the values into the formula

Step#2 Simplify

$a_n = a_1 r^{n-1}$

$a_{10} = 2(2)^{10-1}$

$a_{10} = 2(2)^9$

$\mathbf{a_{10} = 1024}$

Section 4

Sigma Notation

3

Σ 2n

N=1

Step#1: Plug in all numbers from the bottom number till the top number.

Step #2: Simplify your answer and add all answers.

3

Σ 2n

N=1

2(1) + 2(2) + 2(3)

2 + 4 +6 = 12

Arithmetic Series Sheet

2, 4, 6, 8, 10, 12, 14, 16, 18, 20

Find the sum of the first 10 term

Use the following formula: $S_n = n/2\ (a_1 + a_n)$

n = Total number in the sequence

S_n = sum of all the answers in your sequence

a_1 = first term of your sequence

a_n = Last anwhich answer are you looking for

Step#1 Plug all the values into the formula

Step#2 Simplify

$S_n = n/2\ (a_1 + a_n)$

$S_{10} = 10/2\ (a_1 + a_{10})$

$S_{10} = 5\ (2 + 20)$

$S_{10} = 5\ (22)$

$S_{10} = 110$

Geometric Series Sheet

2, 4, 8, 16, 32, 64, 128, 256, 512, 1024

Find the sum of the first 10 term

Use the following formula: $S_n = a_1(1-r^n)/(1-r)$

n = Total number in the sequence

S_n = sum of all the answers in your sequence

a_1 = first term of your sequence

r = Common Multiple

Step#1 Plug all the values into the formula

Step#2 Simplify

$S_n = a_1(1-r^n)/(1-r)$

$S_{10} = 2(1-2^{10})/(1-2)$

$S_{10} = 2046$

Section 7

Recursive Sequences

$a_n = n+4$

Find the first 5 answers in the sequence

n = Number in the Sequence to plug in

a_n = Which ever answer you are looking for in the sequence

Step#1 Plug all the values into the formula

Step#2 Simplify

$a_n = n+4$

$a_1 = 1+4 = 5$

$a_2 = 2+4 = 6$

$a_3 = 3+4 = 7$

$a_4 = 4+4 = 8$

$a_5 = 5+4 = 9$

Chapter 13

Remaining Topics

Section 1

Worksheets