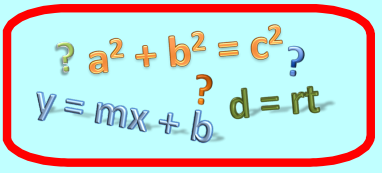
Math 115

Spring 2018

Lecture 1



Math 115 ⇒ Math 107

M – Th ⇒ M – Th

6:15 – 8:45 ⇒ 9:00 – 9:30

You must also have access to Canvas and regular access to the internet.

Max hours You can miss is about 6 hours.

Order of operations:

① Do groups first : ( ), [ ], { }, | |, $\sqrt{}$, $\frac{}{}$

② Exponents & Roots

③ Multiplication & Division from left to right.

④ Addition & Subtraction from left to right.

Evaluate: $\sqrt{4^3 - 7^2 + 1}$

$= \sqrt{64 - 49 + 1}$

$= \sqrt{15 + 1}$

$= \sqrt{16} = \boxed{4}$

$(\sqrt{100} - \sqrt{25})^3$

$= (10 - 5)^3$

$= 5^3$

$= \boxed{125}$

Evaluate: $-|-12|-2\cdot\sqrt{4\cdot10-2^2}$

$=-|-12|-2\cdot\sqrt{4\cdot10-4}$

$=-|-12|-2\cdot\sqrt{40-4}$

$=-|-12|-2\cdot\sqrt{36}$

$=-12-2\cdot6$

$=-12-12$

$=-12+(-12)=\boxed{-24}$

Simplify: $\dfrac{(-2)^5-4^1}{\sqrt{64}\quad-2^3}$

$=\dfrac{-32-4}{8-8}=\dfrac{-32+(-4)}{0}=\dfrac{-36}{0}$

undefined

$\emptyset$

Your turn: $\dfrac{(-8)^2+(-6)^2-10\cdot\sqrt{100}}{4^2-5^2+(-3)^2}$

$=\dfrac{64+36-10\cdot10}{16-25+9}=\dfrac{100-100}{-9+9}=\dfrac{0}{0}$

Indeterminate

Expression is a combination of numbers, operations, and letters (variables)

$3x+5$ $\quad 2x^2-5x+4$ $\quad \sqrt{x^2+y^2}$

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

To evaluate an expression simply replace the variable with the given value, then follow order of operations.

Evaluate $3x+5$ for $x=-2$.

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

$= -6+5$

$= \boxed{-1}$

Evaluate x^2+y^3 for $x=-8$, and $y=-4$.

$x^2+y^3 = (-8)^2+(-4)^3 = 64+(-64) = \boxed{0}$

Do not use $\emptyset$ for zero.

Evaluate $\sqrt{b^2-4ac}$ for $a=1$, $b=-5$, and $c=4$.

$$\sqrt{b^2-4ac} = \sqrt{(-5)^2-4(1)(4)}$$

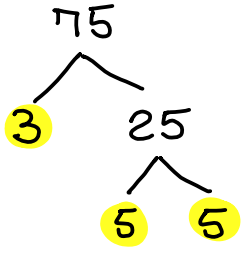
$$= \sqrt{25-16} = \sqrt{9} = \boxed{3}$$

Evaluate $\dfrac{y_2-y_1}{x_2-x_1}$ for $x_1=4$, $x_2=-2$, $y_1=-1$, and $y_2=7$

$$\frac{y_2-y_1}{x_2-x_1} = \frac{7-(-1)}{-2-4} = \frac{7+1}{-2+(-4)} = \frac{8}{-6} = \frac{4\cdot 2}{-3\cdot 2}$$

$$= \boxed{\frac{-4}{3}}$$

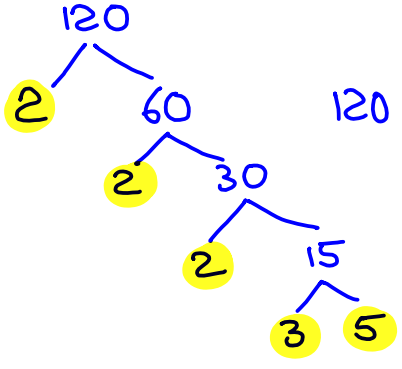
Find Prime Factoriation for 75.



$$75 = 3\cdot 5\cdot 5$$

$$= 3\cdot 5^2$$

Find Prime Factorization for 120.



$$120 = 2\cdot 2\cdot 2\cdot 3\cdot 5$$

$$= 2^3\cdot 3\cdot 5$$

Simplify $\frac{75}{120}$

$$\frac{75}{120} = \frac{3 \cdot 5 \cdot 5}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 5} = \boxed{\frac{5}{8}}$$

Find the reciprocal of $-4\frac{3}{5}$.

↳ Mixed #

Convert it to improper fraction

$$-4\frac{3}{5} = -\frac{23}{5}$$

↑ +

Now reciprocal $\boxed{-\frac{5}{23}}$

We use variables for unknowns.

Some number squared.

x Squared $\Rightarrow x^2$

3 more than twice Some number

x

$2x + 3$

7 less than half Some number squared.

x

x^2

$\frac{1}{2}x^2 - 7$

Distribution Property

$a(b+c) = a \cdot b + a \cdot c$

$a(b-c) = ab - ac$

ex:

$4(x+3) = 4x + 4 \cdot 3$

$= \boxed{4x + 12}$

$5(x^2 - x + 1) = 5x^2 - 5x + 5 \cdot 1$

$= \boxed{5x^2 - 5x + 5}$

Distribute:

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

Distribute & Simplify

$4(x + 2) - 2^3 = 4x + 4 \cdot 2 - 2^3$

$= 4x + 8 - 8$

$= \boxed{4x}$

5 times the sum of Some number and 2 reduced by 10. Translate & Simplify.

$5 \cdot (x + 2) - 10 = 5x + 10 - 10$

Translation

$= \boxed{5x}$

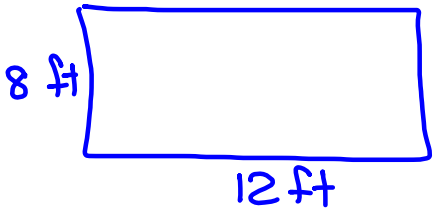
The difference of 10 and square of Some number, multiplied by -5.

$$-5\cdot(10-x^2) = -50+5x^2$$

Translation

Find the area

$A = LW$

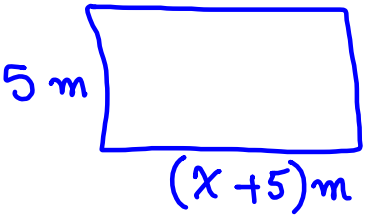


$= 12 \cdot 8$

$A = 96\ ft^2$

Find the area:

$A = LW$



$= 5(x+5)$

$A = (5x + 25)\ m^2$

Translate:

twice Some number (x) reduced by 10

is equal to the sum of the number and 4

$$2x - 10 = x + 4$$ Equation

Properties of 1:

$x \cdot 1 = 1 \cdot x = x$ $\quad 25 \cdot 1 = 25$

$\frac{x}{1} = x$ $\quad 1 \cdot (-30) = -30$

$\frac{x}{x} = 1 \; ; x \neq 0$ $\quad \frac{100}{1} = 100$

$\quad \frac{-46}{-46} = 1$

Properties of 0:

$x + 0 = 0 + x = x$ $\quad 48 + 0 = 48$

$x \cdot 0 = 0 \cdot x = 0$ $\quad 0 + (-100) = -100$

$\frac{x}{0}$ undefined, $x \neq 0$ $\quad 75 \cdot (0) = 0$

$\frac{0}{x} = 0 \; , x \neq 0$ $\quad 0 \cdot (-8) = 0$

Do not use $\emptyset$ for Zero. $\quad \frac{0}{-2018} = 0$ $\quad \frac{125}{0}$ undefined

Sample Quiz

① Evaluate: $(-3^2 - 1)^2 = (-9 - 1)^2$

$= (-10)^2 = \boxed{100}$

② Evaluate: $\sqrt{x^2 - y^2}$ for $x = 10, y = -8$

$= \sqrt{(10)^2 - (-8)^2} = \sqrt{100 - 64} = \sqrt{36} = \boxed{6}$

③ Distribute & Simplify: $6(x - 2) - |-13| + (-5)^2$

$= 6x - 12 - 13 + 25 = 6x - 25 + 25 = \boxed{6x}$

Rahim Faradineh

323-260-8129

rfaradineh@gmail.com

MATH 115 → M-Th 9:00-11:35

MATH 107 → MW 12:10-1:00PM

MATH 125 → M-Th 9:00-11:35

Oct 23 → Dec. 17.

Simplify

1) $5^2 = 5 \cdot 5 = \boxed{25}$

2) $\sqrt{100} = \boxed{10}$

3) $|-8| = \boxed{8}$

4) $(-3)^3 = (-3)(-3)(-3) = \boxed{-27}$

5) $(-2)^4 = (-2)(-2)(-2)(-2) = \boxed{16}$

6) $-(-(-5)) = \boxed{-5}$

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7) $0 \cdot (-8) = \boxed{0}$

8) $\frac{12}{0}$ undefined $\emptyset$

9) $\frac{0}{-15} = \boxed{0}$

10) $-4^2 = \boxed{-16}$

11) $-(-2)^6 = \boxed{-64}$

Order of operations:

1) Do inside of groups: ( ), [ ], { }

$\frac{\quad}{\quad}$, $\sqrt{\quad}$, ...

2) Do exponents & Roots

3) Multiplication & Division from left to right.

4) Addition & Subtraction from Left to right.

Simplify

$5^2 - 5 \cdot 2 = 25 - 5 \cdot 2$

$= 25 - 10$

$= \boxed{15}$

$\sqrt{100} - |-8| = 10 - |-8|$

$= 10 - 8$

$= \boxed{2}$

$(-3)^4 - 9^2$

$= 81 - 81$

$= \boxed{0}$

Do not use $\emptyset$ for zero.

$(5 \cdot 3 - 3^2) \cdot |-5|$

$= (5 \cdot 3 - 9) \cdot 5$

$= (15 - 9) \cdot 5$

$= 6 \cdot 5$

$= \boxed{30}$

$\dfrac{\sqrt{121} - 5 \cdot 2}{3^2 - 2^3}$

$= \dfrac{11 - 5 \cdot 2}{9 - 8}$

$= \dfrac{11 - 10}{1}$

$= \dfrac{1}{1} = \boxed{1}$

Simplify

$$\frac{7^2 - 3 \cdot 4 + \sqrt{64}}{\sqrt{100} - 5 \cdot 2} = \frac{49 - 12 + 8}{10 - 5 \cdot 2} = \frac{37 + 8}{10 - 10} = \frac{45}{0}$$

undefined

$\emptyset$

Prime numbers are natural numbers greater than 1 and are only divisible by itself and 1.

2, 3, 5, 7, 11, 13, 17, 19, 23, ----

Composite numbers

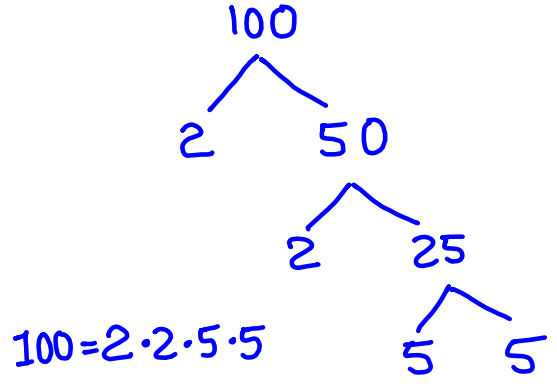
4, 6, 8, 9, 10, 12, ----

The process of taking any composite #, and write it as product of prime numbers is called **Prime factorization.**

$10 = 2 \cdot 5$

$42 = 2 \cdot 21$

$= 2 \cdot 3 \cdot 7$



$100 = 2 \cdot 2 \cdot 5 \cdot 5$

Find prime factorization for

1) 75

$= 3 \cdot 25$

$= 3 \cdot 5 \cdot 5$

$75 = 3 \cdot 5^2$

2) 210

$= 10 \cdot 21$

$= 2 \cdot 5 \cdot 3 \cdot 7$

$210 = 2 \cdot 3 \cdot 5 \cdot 7$

3) 405

$= 5 \cdot 81$

$= 5 \cdot 9 \cdot 9$

$= 5 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

$405 = 3^4 \cdot 5$

Simplify

$-5 \cdot 2 + 2^3 = -5 \cdot 2 + 8$

$= -10 + 8$

$= -2$

$-3 \cdot 4 + (-4)^3 = -3 \cdot 4 + (-64)$

$= -12 + (-64)$

$= -76$

$-6 \cdot (-3) - (-12) = 18 - (-12)$

$= 18 + 12$

$= 30$

$A - B = A + (-B)$

$-8 \cdot 5 - 5^2 = -8 \cdot 5 - 25$

$= -40 - 25$

$= -40 + (-25)$

$= -65$

$$-|-10|\cdot(\sqrt{9}-\sqrt{16})$$

$$=-10(3-4)$$

$$=-10(3+(-4))=-10(-1)=+10$$

$$=\boxed{10}$$

$$\frac{-\sqrt{49}-|-3|}{-\sqrt{25}+2^2}=\frac{-7-3}{-5+4}=\frac{-7+(-3)}{-1}=\frac{-10}{-1}$$

$$=\boxed{10}$$

Expression: Combination of numbers, operations, and letters (Variables).

$3x+5$, x^2-2x , $\sqrt{x^2+y^2}$, $\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

We can simplify or evaluate expressions.

$\boxed{4x}\boxed{-2}+\boxed{3x}\boxed{+8}=\boxed{7x}\boxed{+6}=\boxed{7x+6}$

$\boxed{2x^2}-3x+10+\boxed{3x^2}+3x-9=\boxed{5x^2}+1=5x^2+1$

Evaluate $x^3 + 4x$ for $x = 5$.

Replace every x with the given value

$$x^3 + 4x = (5)^3 + 4(5)$$

$$= 125 + 4 \cdot 5$$

$$= 125 + 20$$

$$= \boxed{145}$$

Evaluate $\sqrt{b^2 - 4ac}$ for $a = 3$, $b = -2$, and $c = -5$.

$$\sqrt{b^2 - 4ac} = \sqrt{(-2)^2 - 4(3)(-5)}$$

$$= \sqrt{4 - 4(3)(-5)}$$

$$= \sqrt{4 - (-60)}$$

$$= \sqrt{4 + 60}$$

$$= \sqrt{64} = \boxed{8}$$

Two 70-Minute lectures with 10-15 minutes break.

Using Common Sense to do translation.

1) The sum of x and 10.

$x + 10$

2) 3 is added to twice x.

$2x + 3$

3) The difference of x^2 and 100.

$x^2 - 100$

3 times x reduced by -10.

$3x - (-10)$

$= 3x + 10$

Square root of x is equal to 5.

$\sqrt{x} = 5$

4 times the Sum of x^2 and -8.

$$4 \cdot (x^2 + (-8)) = 4(x^2 - 8)$$

The quotient of Some number and 5

$$\frac{x}{5}$$

Square of Some number reduced by 6 is equal to five times the number.

$$x^2 - 6 = 5x$$

Twice Some number increased by 8 is equal to the number less 5.

$$2x + 8 = x - 5$$

A less B $\Rightarrow$ A - B, A less than B $\Rightarrow$ B - A

A Added to B $\Rightarrow$ B + A

A Subtract from B $\Rightarrow$ B - A

A more than B $\Rightarrow$ B + A

A less than B $\Rightarrow$ B - A

} Reverse them

John is 5 yrs older than Maria.

Lisa is 8 yrs Younger than Maria.

Age

Maria	John	Lisa
x	$x+5$	$x-8$

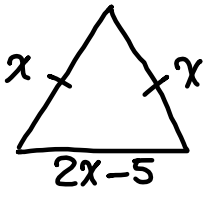
The length of a rectangular garden is

4 ft shorter than

5 times its width.

Draw & label such garden.

Draw a triangle with two equal sides and the third side is 5 inches less than the sum of equal sides.



Looking Ahead

! Factorial , $2! = 2 \cdot 1$

$3! = 3 \cdot 2 \cdot 1$

$4! = 4 \cdot 3 \cdot 2 \cdot 1$

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

Simplify

$4! + 2! = \underbrace{4 \cdot 3 \cdot 2 \cdot 1} + \underbrace{2 \cdot 1}$

$= 24 + 2 = \boxed{26}$

$6! - 5! = \underbrace{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} - \underbrace{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$

$= 720 - 120$

$= \boxed{600}$

$\frac{6!}{4!} = \frac{6 \cdot 5 \cdot \cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}}{\cancel{4} \cdot \cancel{3} \cdot \cancel{2} \cdot \cancel{1}} = 6 \cdot 5 = \boxed{30}$

$0! = 1, \quad 1! = 1$