

M10 - Table of Contents

Duotang/Notes/Homework

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M10 - Methods

Exponent

Laws

Mistakes

$$x + x = x^2$$

$$x \times x = 2x$$

Radical

Laws

Measurement

Conversion Factors

Surface area and volume

Formulas

Polynomials

Distribution

FOIL

GCF

$$a = 1$$

$$a \neq 1$$

$$a^2 - b^2$$

Let $m =$

$$\underline{\hspace{1cm}} \times \underline{\hspace{1cm}} = ac$$

$$\underline{\hspace{1cm}} + \underline{\hspace{1cm}} = b$$

GCF of "1" and "(-1)"

Greatest Common Factor -1:

$$\begin{array}{rcl} -2x + 3 & = & 5 - x \\ -1(2x - 3) & = & -1(-5 + x) \\ & = & -(x - 5) \end{array}$$

Trigonometry

SOH CAH TOA

$$\sin \theta = \frac{\text{opp}}{\text{hyp}} \quad \theta = \sin^{-1}\left(\frac{\text{opp}}{\text{hyp}}\right)$$

$$\cos \theta = \frac{\text{adj}}{\text{hyp}} \quad \theta = \cos^{-1}\left(\frac{\text{adj}}{\text{hyp}}\right)$$

$$\tan \theta = \frac{\text{opp}}{\text{adj}} \quad \theta = \tan^{-1}\left(\frac{\text{opp}}{\text{adj}}\right)$$

Domain :x/Range:y

Words: Any real number less than 10

Interval Notation: $(-\infty, 10)$

Set Notation: $\{x|x < 10, x \in \mathbb{R}\}$

Number Line: \longleftrightarrow

List: $y = 1, 2, 3, 4, 5$ or $(2,4)(5,6)$

Graphing

(x_1, y_1)

$(2, -4)$

(x_2, y_2)

$(-1, -2)$

$$\text{Slope} = m = \frac{\text{rise}}{\text{run}}$$

Slope Formula

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope Intercept

$$y = mx + b$$

Slope Point

$$y - y_1 = m(x - x_1)$$

General/Standard

$$Ax + By + C = 0$$

Function Notation

$$f(x) = mx + b$$

Word Problems

'Let' Statements

Equations

Systems

Substitution

$$a = b \quad c = a$$

$$b = c$$

Elimination

$$\text{EQ1}$$

$$- \text{EQ2} \times 2$$

$$\text{EQ3}$$

Substitution:

Isolate

Substitute

Solve

Substitute

Solve

Intersection (x, y)

Elimination:

Get rid of the fractions

Line up the terms

Multiply

Add or subtract

Solve

Substitute

Solve

Intersection (x, y)

One Solution

$$x = 2$$

No Solution

$$\# \neq \#$$

Infinite

$$\# = \#$$

M10 - Remember

Exponent

Laws

Radical

Laws

$$\sqrt{3^2 + 4^2} = \sqrt{25} = 5 \quad \sqrt{3^2 + 4^2} \neq 3 + 4 = 7$$

$$\sqrt{9 + 16} = \sqrt{25} = 5 \quad \sqrt{x^2 + 4} \neq x + 2$$

$$\sqrt{9} + \sqrt{16} = 3 + 4 = 7$$

$$\sqrt{(-3)^2} \neq \sqrt{-3^2}$$

Measurement

Make units cancel

Surface area and volume

Formulas

Width of rectangle in Cylinder is Circumference

$$v = A_b \times h ; \text{Base must be same as top.}$$

Polynomials

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

$$(3 + 4)^2 = (3 + 4)(3 + 4) = 7 \times 7 = 7^2 = 49$$

Common Mistakes:

$$(x + 3)^2 \neq x^2 + 3^2$$

$$(3 + 4)^2 \neq 3^2 + 4^2 = 25$$

Linear Relations

Positive slopes go up to the right

Negative slopes go up to the left.

Zero slopes are horizontal

Undefined slopes are Vertical

Domain Range

When working with domain and range make sure you use your hands to cover the included part of the graph to help narrow out for domain and range

Graphing

Slope Intercept TOV " b, m "

Slope Point $(x, y), m$

General TOV $(x, 0) x - \text{int}$ and $(0, y) y - \text{int}$

General Form: No fractions No decimals $+x, y, \# = 0$

Perpendicular Slope: The Negative Reciprocal: $m = -\frac{1}{m}$

Word Problems

general form is for two multiplications

Slope intercept form is for one multiplication and an addition

Negatives

Trigonometry

We can't multiply into sine, cosine or tangent.

Calculator Degree or Radian mode?

$$\theta = \cos^{-1}(0.8) \quad \text{OR} \quad \theta = \cos^{-1}\left(\frac{4}{5}\right)$$

$$\theta = 36.9^\circ \quad \theta = 36.9^\circ$$

It doesn't matter if you
abc⁻¹() decimals or fractions

$$\sin \theta \geq 1$$

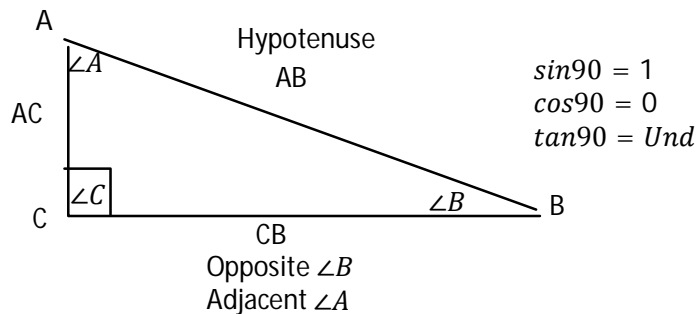
$$\theta = DNE$$

$$\cos \theta \geq 1$$

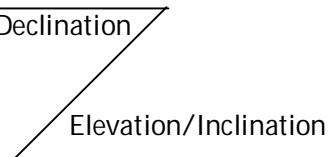
$$\theta = DNE$$

Sin or Cos can't be
larger than 1.

Opposite $\angle B$
Adjacent $\angle A$



Depression/Declination



Linear Systems

(x, y)

One Solution: $x = \#$

No Solutions: $\# \neq \#$

Infinite Solutions: $\# = \#$

Substitution

Put brackets around
what you're subtracting

Elimination

LCM Principle

Functions:

$$f(x) \neq f \times x$$

$f(x)$ means f is a
function of x .

$$f(x) = y$$

Use the ratio that uses information you have and are looking for.

M10 - Function Notation

$$y = f(x) = y$$

$$f(x) = x + 2$$

$$y = x + 2$$

$$y(3) = 3 + 2$$

$$f(3) = ? \quad (3, y)$$

What is y when x is 3. Put 3 in for x .

$$f(x) = x + 2$$

$$f(3) = 3 + 2$$

$$f(3) = 5 \quad (3, 5)$$

Put whatever is inside the brackets in for x ! So simple.

$$f(x) = 6 \quad (x, 6)$$

What is x when y is 6. Put 6 in for $f(x)$.

$$f(x) = x + 2$$

$$6 = x + 2$$

$$-2 \quad -2$$

$$4 = x$$

$$x = 4 \quad (4, 6)$$

$$f(x + 2) = ?$$

$$f(x) = x + 2$$

$$f(x + 2) = (x + 2) + 2$$

$$f(x + 2) = x + 4$$

Put $x + 2$ in for f 's x

$$f(2x) = ?$$

$$f(x) = x + 2$$

$$f(2x) = (2x) + 2$$

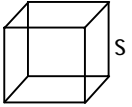
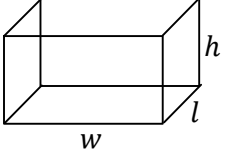
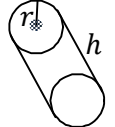
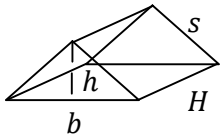
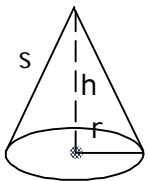
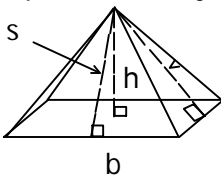
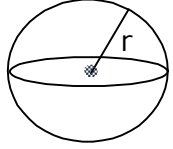
$$f(2x) = 2x + 2$$

Put $2x$ in for f 's x

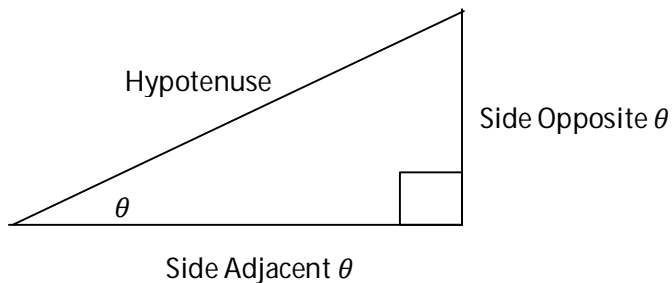
M10 - 1.0 - Conversion Factors

Units	Conversions	Conversion Factors
<u>Metric</u>		
Millimeter (mm)	$10mm = 1cm$	$\frac{10mm}{1cm}$ $\frac{1cm}{10mm}$
Centimeter (cm)	$100cm = 1m$	$\frac{100cm}{1m}$ $\frac{1m}{100cm}$
Meter (m)	$1000m = 1km$	$\frac{1000m}{1km}$ $\frac{1km}{1000m}$
Kilometer (km)		
<u>Imperial</u>		
Inch (in)	$12in = 1ft$	$\frac{12in}{1ft}$ $\frac{1ft}{12in}$
Foot (ft)	$3ft = 1yd$	$\frac{3ft}{1yd}$ $\frac{1yd}{3ft}$
Yard (yd)	$1760yd = 1mi$	$\frac{1760yd}{1mi}$ $\frac{1mi}{1760yd}$
Mile (mi)		
<u>Metric to Imperial</u>		
Centimeters (cm) to Inches (in)	$2.54cm = 1in$	$\frac{2.54cm}{1in}$ $\frac{1in}{2.54cm}$
Meters (m) to Feet (ft)	$3.3ft = 1m$	$\frac{3.3ft}{1m}$ $\frac{1m}{3.3ft}$
<u>Time</u>		
Second (s)	$60s = 1min$	$\frac{60s}{1min}$ $\frac{1min}{60s}$
Minute (min)	$60min = 1hr$	$\frac{60min}{1hr}$ $\frac{1hr}{60min}$
Hour (hr)		
<u>Rates</u>	$\frac{km}{hr}$	$\frac{m}{s}$

M10 - 2.0 - Surface Area Volume Review

Shape	Surface Area	Volume
Cube 	$SA = s^2 \times 6$	$V = Area_{base} \times height$ $V = lwh$
Rectangular Prism 	$SA = 2(lw + lh + wh)$	$V = Area_{base} \times height$ $V = lwh$
Cylinder 	$SA = 2\pi r^2 + 2\pi rh$	$V = Area_{base} \times height$ $V = \pi r^2 h$
Triangular Prism 	$SA = 2\left(\frac{bh}{2}\right) + 2(s \times H) + bH$	$V = Area_{base} \times height$ $V = \frac{bh}{2} \times H$
Cone 	$SA = \pi r^2 + \pi rs$	$V = \frac{1}{3} Area_{base} \times height$ $V = \frac{1}{3} \times (\pi r^2) \times h$
Square-Based Pyramid 	$SA = 2bs + b^2$	$V = \frac{1}{3} Area_{base} \times height$ $V = \frac{1}{3} \times l \times w \times h$
Sphere 	$SA = 4\pi r^2$	$V = \frac{4}{3} \pi r^3$
General Right Pyramid	$SA = \text{sum of areas of faces}$	$V = \frac{1}{3} Area_{base} \times height$ $V = \frac{1}{3} \times l \times w \times h$

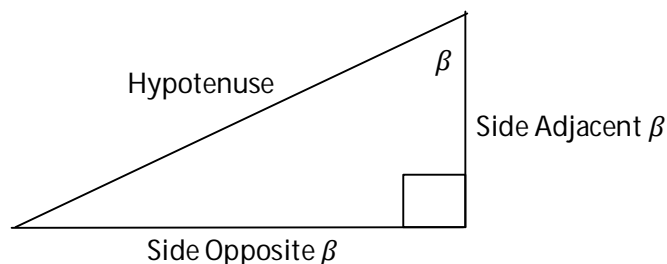
M10 - 3.0 - Trigonometry Review



Hypotenuse: Always the longest side, opposite of the 90° angle.

Adjacent: The side touching angle θ .

Opposite: The side opposite of angle θ . 180° in a triangle.



SOH CAH TOA

$$\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

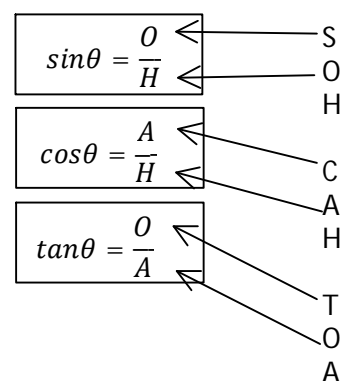
$$\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

$$\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\sin\theta = \frac{\text{opp}}{\text{hyp}}$$

$$\cos\theta = \frac{\text{adj}}{\text{hyp}}$$

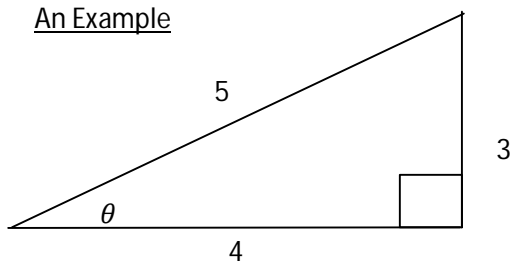
$$\tan\theta = \frac{\text{opp}}{\text{adj}}$$



$$a = h\cos\theta$$

$$o = h\sin\theta$$

An Example



Sine Ratio

$$\sin\theta = \frac{O}{H}$$

$$\sin\theta = \frac{3}{5}$$

$$\sin\theta = 0.6$$

$$\theta = \sin^{-1}(0.6)$$

$$\theta = 36.9^\circ$$

Cosine Ratio

$$\cos\theta = \frac{A}{H}$$

$$\cos\theta = \frac{4}{5}$$

$$\cos\theta = 0.8$$

$$\theta = \cos^{-1}(0.8)$$

$$\theta = 36.9^\circ$$

Tangent Ratio

$$\tan\theta = \frac{O}{A}$$

$$\tan\theta = \frac{3}{4}$$

$$\tan\theta = 0.75$$

$$\theta = \tan^{-1}(0.75)$$

$$\theta = 36.9^\circ$$

Notice how they are all the same. That is because it is the same angle, just found using different ratios.

$$\frac{a}{c} = \frac{b}{c}$$

Times both sides by "c"

$$\frac{c \times a}{a} = \frac{b}{a}$$

Divide both sides by "a"

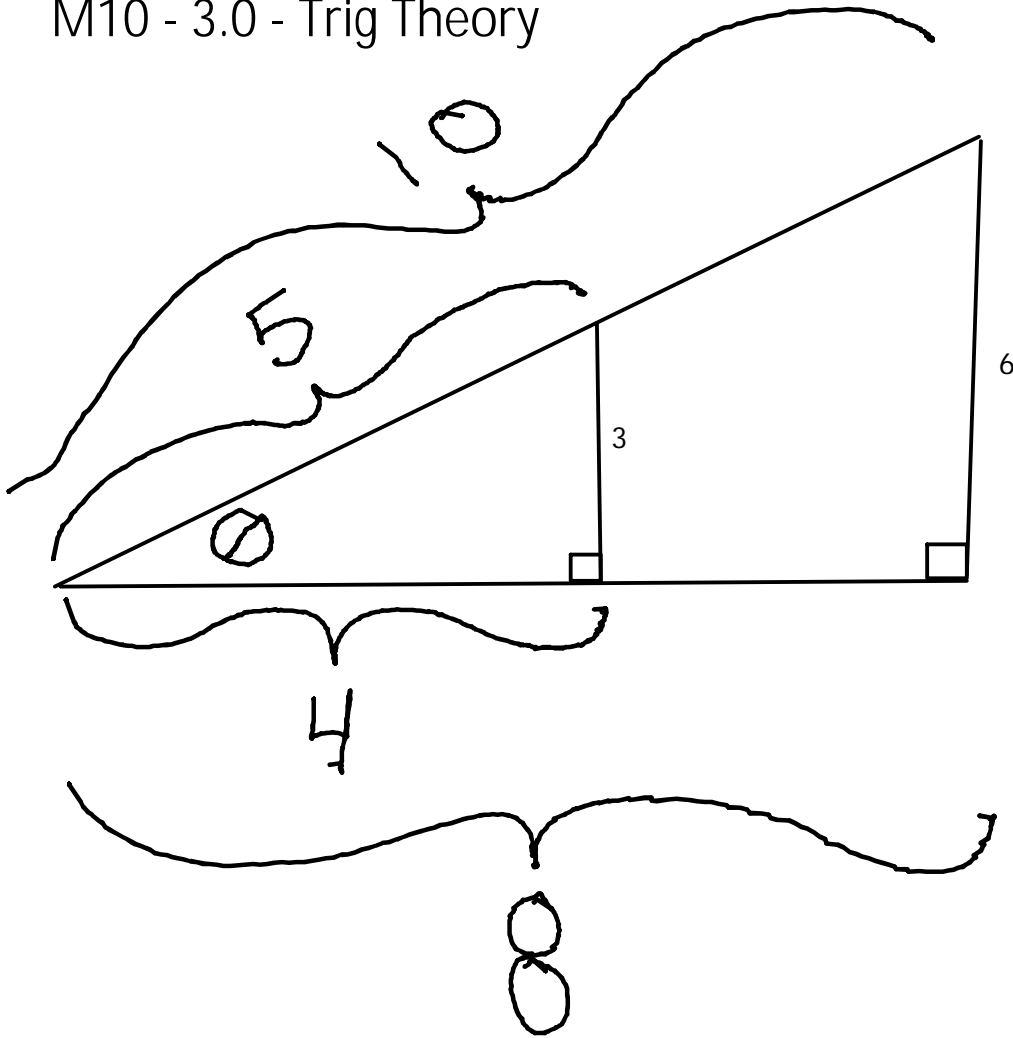
Or!

$$\frac{a}{c} = \frac{b}{c}$$

Switch "a" and "c"

Want to choose the part of SOH CAH TOA that has 2 pieces of info that we have, and one we are looking for.

M10 - 3.0 - Trig Theory



$$\sin \theta = \frac{O}{H}$$

$$\sin \theta = \frac{3}{5}$$

$$\sin \theta = 0.6$$

$$\cos \theta = \frac{A}{H}$$

$$\cos \theta = \frac{4}{5}$$

$$\cos \theta = 0.8$$

$$\tan \theta = \frac{Opp}{Adj}$$

$$\tan \theta = \frac{3}{4}$$

$$\tan \theta = 0.75$$

$$\sin \theta = \frac{O}{H}$$

$$\sin \theta = \frac{6}{10}$$

$$\sin \theta = 0.6$$

$$\cos \theta = \frac{A}{H}$$

$$\cos \theta = \frac{8}{10}$$

$$\cos \theta = 0.8$$

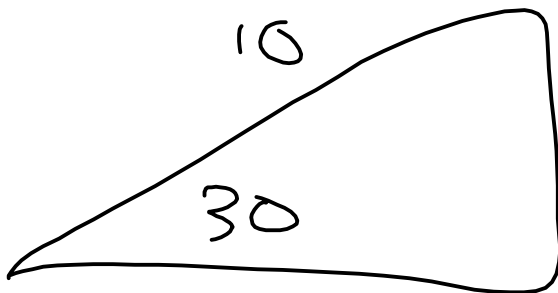
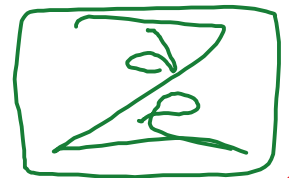
$$\tan \theta = \frac{Opp}{Adj}$$

$$\tan \theta = \frac{6}{8}$$

$$\tan \theta = 0.75$$

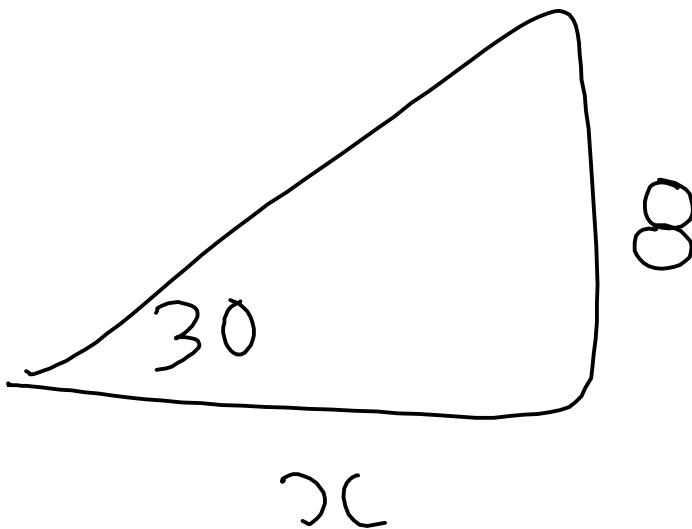
Notice the ratios of similar triangles for each trig ratio is the same respectively.

M10 - 3.0 - Trig Summary



$$\cancel{10} \sin 30 = \frac{x}{\cancel{10}}$$

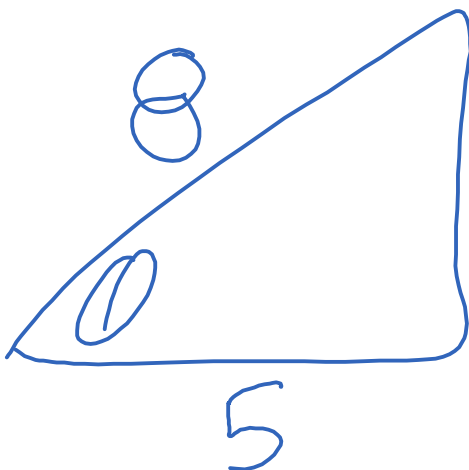
$$x = 5$$



$$\tan 30 = \frac{8}{x}$$

$$x = \frac{8}{\tan 30}$$

$$x = 13.8$$



$$\cos \theta = \frac{5}{8}$$

$$\theta = \cos^{-1}\left(\frac{5}{8}\right)$$

$$\theta = 51.3$$

M10 - 5.0 - Factoring Review

"a" is the number in front of the x^2 term.
 "b" is the number in front of the x term.
 "c" is the number by itself.

Don't Forget To Check By Distribution/FOIL

1) Factoring: $bx + c$

$$12x + 8$$

$$4(3x + 2)$$

Remove Greatest Common Factor "GCF."

2) Factoring: $ax^2 + bx + c$

$$a = 1$$

$$\underline{2} \times \underline{3} = \cancel{6}$$

$$* ac = c$$

$$1, 2, 3, 6$$

Decompose
 Group
 GCF
 Switch

$$\underline{2} + \underline{3} = \cancel{5}$$

$$x^2 + 5x + 6$$

$$(x + 2)(x + 3)$$

3) Factoring: $ax^2 + bx + c$

$$a \neq 1$$

$$\underline{3} \times \underline{4} = \cancel{ac} 12$$

$$\underline{3} + \underline{4} = \cancel{b} 7$$

Decompose
 Group
 GCF
 Switch

$$2x^2 + 7x + 6$$

$$(x + 2)(2x + 3)$$

4) Factoring: $a^2 - b^2$

Differences of Squares

$$x^2 - 9$$

$$(x + 3)(x - 3)$$

$$a^2 - b^2 = (a + b)(a - b)$$

$$= a^2 - \cancel{ab} - \cancel{ab} - b^2$$

5) Factoring: $ax^2 + bxy + cy^2$

$$x^2 + 2xy + y^2$$

$$(x + y)(x + y)$$

$$(x + y)^2$$

M10 - 7.0 - Graphing Review

(x, y)

$y = f(x) = y$

Slope- Intercept

$$y = mx + b$$

\nearrow slope \nearrow y-intercept

m = slope

b = y-intercept

$$y = mx + b$$

x	y
-2	
-1	
0	
1	
2	

$$y = \frac{2}{3}x + 1$$

Increments of x
by denominator
of slope away
from zero

$$y = mx + b$$

x	y
-6	
-3	
0	
3	
6	

Slope-Point

$$y - y_1 = m(x - x_1)$$

\nearrow y coordinate \nearrow slope \nwarrow x coordinate

Plot Point
Use Slope

Find Slope
Find Point

General/Standard

$$Ax + By = C$$

$$Ax + By + C = 0$$

$$m = -\frac{A}{B}$$

$$y - int = \pm \frac{C}{B}$$

$$Ax + By = C$$

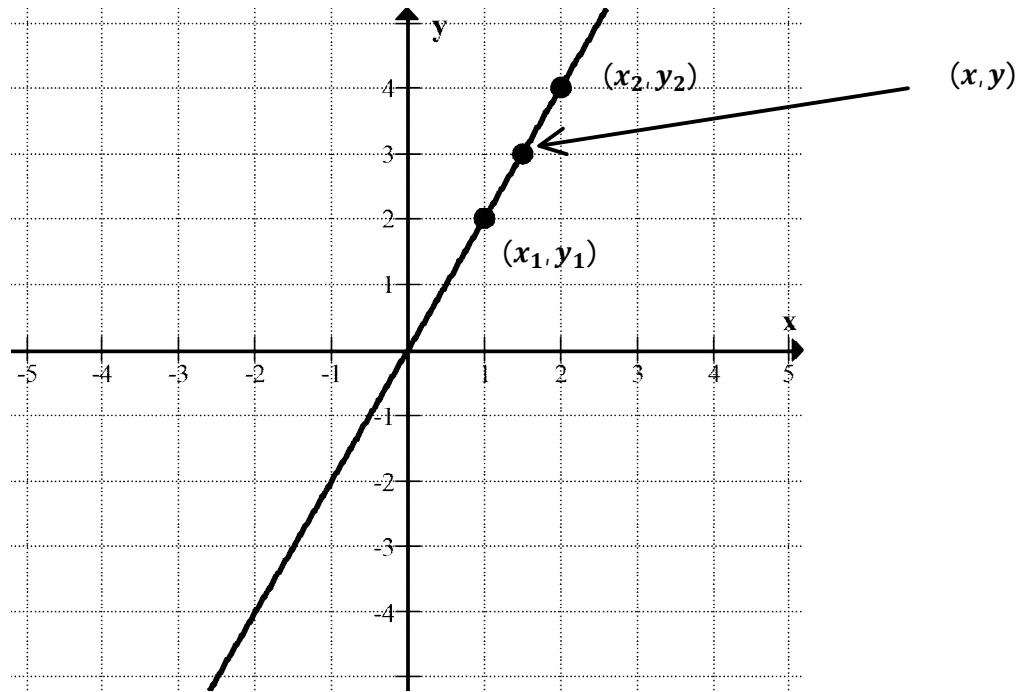
x	y
0	
	0

Finding y-intercept $(0, y)$: Set $x = 0$, Solve for y

Finding x-intercept $(x, 0)$: Set $y = 0$, Solve for x

No Fractions
X term positive
 $x, y, \#$

M10 - 7.0 - Formula Theory



Point Slope Form

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope

$$m = \frac{y - y_1}{x - x_1}$$

$$m \times (x_2 - x_1) = \frac{y - y_1}{x - x_1} \times (x - x_1)$$

$$m(x - x_1) = y - y_1$$

$$y - y_1 = m(x - x_1)$$

Point Slope

$$y - y_1 = m(x - x_1)$$

Point Slope

$$y - y_1 = mx - mx_1$$

$$+ y_1 \qquad + y_1$$

$$y = mx - mx_1 + y_1$$

$$y = mx + (-mx_1 + y_1)$$

$$y = mx + b$$

y - intercept

$$y - y_1 = m(x - x_1)$$

Point Slope

$$y - y_1 = \frac{\text{rise}}{\text{run}} (x - x_1)$$

$$y - y_1 = \frac{B}{A} (x - x_1)$$

$$(y - y_1) \times A = \frac{B}{A} (x - x_1) \times A$$

$$Ay - Ay_1 = Bx - Bx_1$$

$$Ay - Bx - Ay_1 + Bx_1 = 0$$

$$Ay + (-Bx) + (-Ay_1 + Bx_1) = 0$$

$$Ay + Bx + C = 0$$

General Form

M10 - 9.0 - Sub, Elim, Graph Review

Substitution

$$y = (x + 1)$$

$$(y) = 2x - 2$$

$$\begin{aligned} (y) &= 2x - 2 \\ (x + 1) &= 2x - 2 \\ 1 &= x - 2 \\ x &= 3 \end{aligned}$$

$$\begin{aligned} y &= x + 1 \\ y &= 3 + 1 \\ y &= 4 \end{aligned}$$

(3,4)

Elimination

$$y = x + 1$$

$$y = 2x - 2$$

$$\begin{array}{r} y = 2x - 2 \\ - \quad y = x + 1 \\ \hline 0 = x - 3 \end{array}$$

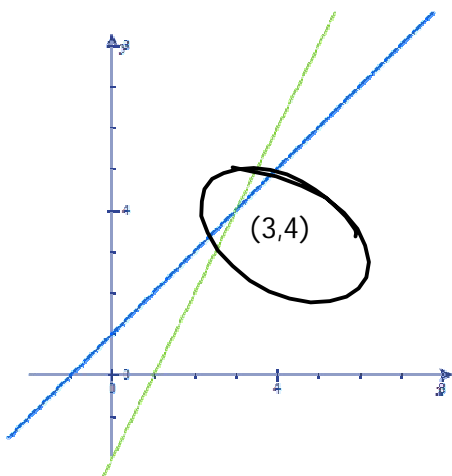
$$\begin{aligned} (-2) - 1 &= \\ (-2) - 1 &= -3 \end{aligned}$$

$$x = 3$$

$$\begin{aligned} y &= x + 1 \\ y &= 3 + 1 \\ y &= 4 \end{aligned}$$

(3,4)

Graphing



Substitution:

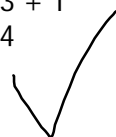
Isolate
Substitute
Solve
Substitute
Solve
Intersection

Elimination:

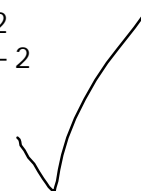
Get rid of the fractions
Line up the terms
Multiply
Add or subtract
Solve
Substitute
Solve
Intersection

Check Your Answer

$$\begin{aligned} y &= x + 1 \\ 4 &= 3 + 1 \\ 4 &= 4 \end{aligned}$$



$$\begin{aligned} y &= 2x - 2 \\ 4 &= 2(3) - 2 \\ 4 &= 6 - 2 \\ 4 &= 4 \end{aligned}$$



One Solution

$$x = 2$$

No Solution

$$\# \neq \#$$

Infinite

$$\# = \#$$

$$ax+by=c$$

fries \$3
coke \$2

HAVE 24\$

$$3f + 2c = 24$$



$$c = \frac{-3f + 12}{2}$$

$$y=mx+b$$

\$50/hr

\$1000 RENT

$$D = 50h - 1000$$