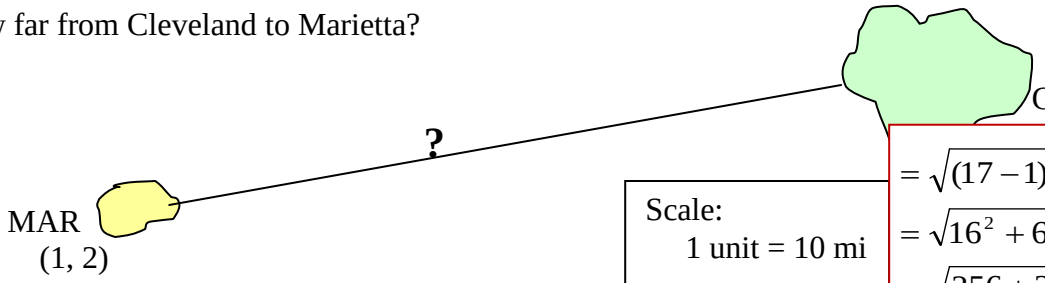
CRM
SECTION 1A

POINTS & LINES

How far from Cleveland to Marietta?



Scale:
1 unit = 10 mi

$= \sqrt{(17-1)^2 + (8-2)^2}$
$= \sqrt{16^2 + 6^2}$
$= \sqrt{256 + 36}$
$= \sqrt{292} \approx 17.1 \bullet 10 = 170 miles$

If New Philadelphia is exactly half way between Marietta & Cleveland, at what coordinates would it be located on the map grid?

$= \left(\frac{1+17}{2}, \frac{2+8}{2}\right)$
$= \left(\frac{18}{2}, \frac{10}{2}\right)$
$= (9,\ 5)$

$= \left(\frac{3+11}{2}, \frac{2+8}{2}\right)$
$= \left(\frac{14}{2}, \frac{10}{2}\right)$
$= (7,\ 5)$

DISTANCE AND MIDPOINT FORMULAS

$D = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

EXAMPLES: Find the length of $\overline{XY}$ and then the coordinates of its midpoint.
Do not round answers, put radicals in simplest form.

1) X(3, 2) & Y(11, 8)

$d = \sqrt{(11-3)^2 + (8-2)^2}$
$= \sqrt{8^2 + 6^2}$ .....*midpt.*
$= \sqrt{64 + 36}$ $= \left(\frac{3+11}{2}, \frac{2+8}{2}\right)$
$= \sqrt{100}$
$= 10$ $= \left(\frac{14}{2}, \frac{10}{2}\right)$
$= (7,\ 5)$

2) X(-5, -3) & Y(-2, -9)

$d = \sqrt{(-2+5)^2 + (-9+3)^2}$
$= \sqrt{3^2 + (-6)^2}$ .....*midpt.*
$= \sqrt{9 + 36}$ $= \left(\frac{-5-2}{2}, \frac{-3-9}{2}\right)$
$= \sqrt{45}$
$= 3\sqrt{5}$ $= \left(\frac{-7}{2}, \frac{-12}{2}\right)$
$= (-3.5,\ -6)$

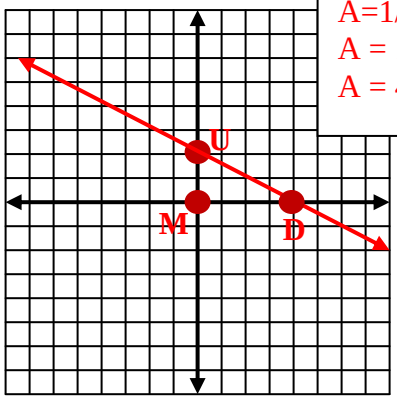
3) $X\left(\frac{1}{2}, -\frac{1}{4}\right)$ & $Y\left(\frac{7}{4}, \frac{11}{4}\right)$

$d = \sqrt{\left(\frac{7}{4} - \frac{1}{2}\right)^2 + \left(\frac{11}{4} + \frac{1}{4}\right)^2}$
$= \sqrt{\left(\frac{5}{4}\right)^2 + 3^2}$ .....*midpt.*
$= \sqrt{\frac{25}{16} + 9}$ $= \left(\frac{1/2 + 7/4}{2}, \frac{-1/4 + 11/4}{2}\right)$
$= \sqrt{\frac{169}{16}}$ $= \left(\frac{9/4}{2}, \frac{5/2}{2}\right)$
$= 13/4$ $= (9/8,\ 5/4)$

GRAPHING & BEYOND

EXAMPLES: Graph the equation given. Label the origin and the x&y-intercepts as points M, U and D respectively. Find the area of ΔMUD.

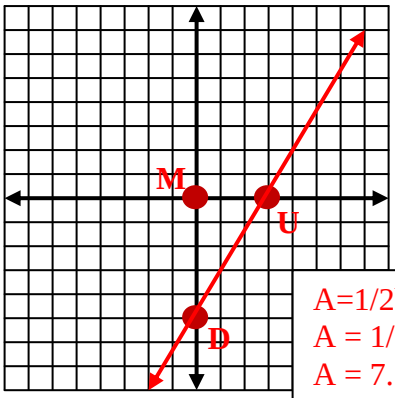
4) $y = -\frac{1}{2}x + 2$



A=1/2bh
A = 1/2(4)(2)
A = 4 units^2

5) $5x - 3y = 15$

Solve for y
-3y = -5x + 15
y = 5/3x – 5



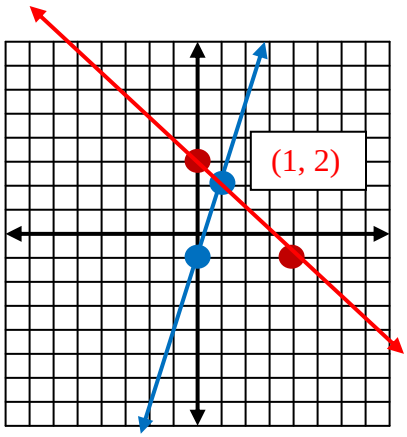
A=1/2bh
A = 1/2(3)(5)
A = 7.5 units^2

Intersection points

EXAMPLES: Graph the systems of equations, then label the intersection point.

6) $y = 3x - 1$
$2x + 2y = 6$

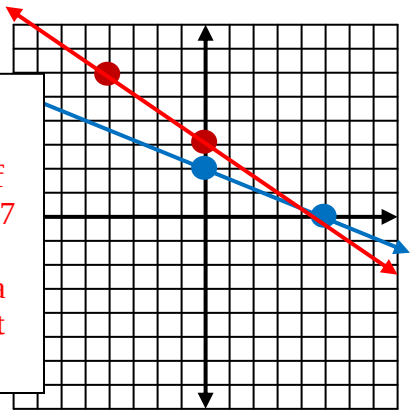
Solve for y
2y = -2x + 6
y = -x + 3



7) $2x + 5y = 10$
$3x + 4y = 12$

Solve for y
5y = -2x + 10
y = -2/5x + 2

4y = -3x + 12
y = -3/4x + 3



Oh, darn! Can't label the point of intersection on #7 because it does not intersect on a grid mark. What shall we do?

SOLVING SYSTEMS WITHOUT GRAPHING

Do you remember solving systems of equations algebraically? Does the substitution and/or elimination method ring a bell? Resolve #6 with the substitution method and #7 with elimination.

EXAMPLES:

6) $y = 3x - 1$
$2x + 2y = 6$

SUBSTITUTION

Plug the first equation into the second.
$2x + 2(3x - 1) = 6$
$2x + 6x - 2 = 6$
$8x - 2 = 6$ Now plug x = 1 in
$8x = 8$ $y = 3(1) - 1$
$x = 1$ $y = 2$
(1, 2)

7) $2x + 5y = 10$
$3x + 4y = 12$

ELIMINATION

Multiply either (or both) equations by something so one variable will cancel.
$(3) \bullet\ 2x + 5y = 10 \rightarrow \quad 6x + 15y = 30$
$(-2) \bullet\ 3x + 4y = 12 \rightarrow \quad -6x - 8y = -24$
$7y = 6$
$y = 6/7$
Plug y = 6/7 in to either equation.
$2x + 5(6/7) = 10$
$2x + 30/7 = 10$
$2x = 40/7 \quad x = 20/7 \quad (20/7, 6/7)$

STRETCH YER' BRAINS!

Determine (prove) that quadrilateral ***ABCD*** is a parallelogram.

A(1, 7), B(3, 5), C(4, -1), D(2, 1) Good luck and may the force be with you. $m = \frac{y_2 - y_1}{x_2 - x_1}$

Drawing it would help, but as you hopefully learned in Geometry, a drawing proves nothing.

A parallelogram has opposite parallel sides. Show that AB & CD are parallel, and AD & BC are parallel:

$AB_m = \frac{5-7}{3-1} = \frac{-2}{2} = -1$

$CD_m = \frac{1-(-1)}{2-4} = \frac{2}{-2} = -1$

$AD_m = \frac{1-7}{2-1} = \frac{-6}{1} = -6$

$BC_m = \frac{-1-5}{4-3} = \frac{-6}{1} = -6$