Tue. 11/18 Agenda:

* Return Exams & Discuss
* 8.1 Circles - Wrap Up
  HW: (Originally assigned last Tuesday)
  #3, 4, 7, 9, 21 - 37 odd, 38, 39-43 odd, 53, 57, 59, 62, 65
* Lines and Slope HW:
  8.2 HW #15, 25, 27, 29, 31, 39, 41, 45, 47, 57, 63, 64
  8.3 HW #1 - 4, 17 - 63 every other odd, 67, 69, 74
* **No class Wednesday** (Fall Educators Workshop @ UW-L)
  Attending: "*Differentiated Instruction*" with Roger Taylor

Parent Evening: November 18, 2008; 6:30-8 p.m.
Educator Workshop: November 19, 2008; 8:30 a.m.-2:30 p.m.

CHANGE IN LOCATION:
The **Parent Evening** will be held in 140 Cowley Hall, UW-La Crosse Campus.
The **Educator Workshop** will be held in Valhalla A, UW-La Crosse Campus.
.5 CEUs

$85 Educator Registration Fee ($80 for 3 or more registering from same district)
$9 Parents Registration Fee (includes refreshments)

Recall:

1. The distance between (x, y) and (h, k) is calculated as:

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$
$$d = \sqrt{(x-h)^2 + (y-k)^2}$$

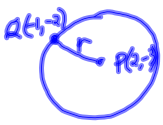
2. The midpoint of the points (x, y) and (h, k) is the point:

$$M = \left(\frac{x+h}{2}, \frac{y+k}{2}\right)$$

Circles

Definition: The circle centered at *P* with radius *r* is the set of all points that are a distance of *r* units away from *P*.

1. Find the radius of the circle centered at *P*(2, –3), given that *Q*(–1, –2) is a point on the circle.



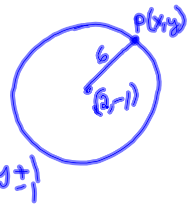
$$r = \sqrt{(2-(-1))^2 + (-3-(-2))^2}$$
$$= \sqrt{9 + (-1)^2} = \sqrt{10}$$

2. Find the radius of the circle centered at *P*(h, k) if the point *Q*(x, y) lies on the circle.

$$r = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$
$$r = \sqrt{(x-h)^2 + (y-k)^2}$$

Circles:

Find the equation of a circle with a radius of 6 units and center at (2,-1).



$$d = 6 = \sqrt{(x-2)^2 + (y-(-1))^2}$$
$$6^2 = (x-2)^2 + (y+1)^2$$
$$36 = x^2 - 4x + 4 + y^2 + 2y + 1$$
$$-5 \quad -4 \quad -1$$
$$\rightarrow 31 = x^2 - 4x + y^2 + 2y$$

Circles:

* Sometimes we need to complete the square to find the equation of a circle.
* Recall that $(x - h)^2 + (y - k)^2 = r^2$ is the equation of the circle centered at (h, k) with radius r.

Complete the square to find the center and radius of the circle with the equation:

$$x^2 + y^2 - 6y + 16x - 8 = 0$$

$$(x^2 + 16x + 64) + (y^2 - 6y + 9) = 8 + 64 + 9$$
$$(x+8)^2 + (y-3)^2 = 81$$
$$(x-(-8))^2 + (y-3)^2 = 9^2$$

Center: $(h, k) = (-8, 3)$
radius: $r = 9$

Lines and Slope

The slope *m* of a line is defined as the (change in y) divided by the (change in x).

So *m* = rise / run.

Find the slope of the line through:

a) (-2, 5) and (-4,4) $\quad m = \frac{\Delta y}{\Delta x} = \frac{4-5}{-4-(-2)} = \frac{-1}{-2} = \frac{1}{2}$

b) (-2, 5) and (-2, -7) $\quad m = \frac{\Delta y}{\Delta x} = \frac{-7-5}{0} \rightarrow$ no slope (undefined) (no change in x)

c) (-2, 5) and (-4, 5) $\quad m = \frac{\Delta y}{\Delta x} = \frac{5-5}{-4-(-2)} = \frac{0}{-2} = 0.$

Lines -- Three forms:

$Ax + By = 9$

$\frac{By}{B} = -\frac{Ax}{B} + \frac{9}{B}$

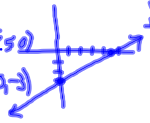
1. Standard Form: Ax + By = C is a linear equation in two variables (provided A and B are not both 0).

Example: Describe the line 2x - 3y = 9. $\rightarrow$ slope $= -\frac{A}{B}$

slope

x-intercept: (4.5, 0)

y-intercept (0, -3)



to find x-intercept, set y=0.

$2x = 9$

$x = 9/2$

$m = \frac{0-(-3)}{4.5-0} = \frac{3(2)}{4.5(2)} = \frac{6}{9} = \frac{2}{3}$ ✓

2. Slope-Intercept Form: $y = mx + b$ is the linear equation in two variables with slope m and y-intercept $(0,b)$.

Example: Express the line 2x - 3y = 9 in slope-int. form.

Solve for y:

$\frac{-3y}{-3} = \frac{-2x+9}{-3}$

$y = \frac{-2x}{-3} + \frac{9}{-3}$

$y = \frac{2}{3}x - 3$

Lines -- Three forms:

3. Point-Slope Form: The equation $\boxed{y - y_0 = m(x - x_0)}$ is a linear equation in two variables with slope m that contains the point (x_0, y_0).

Why does it work? If (x_0, y_0) is the given point, and m is the given slope of the desired line, then all other points (x, y) satisfy:

$(x-x_0)\, m = \frac{y-y_0}{(x-x_0)}\,(x-x_0) \iff (x-x_0)(m) = y-y_0$

Example: Find the equation of the line through $(-2, 5)$ and $(-4, 4)$.

(x_0, y_0)

(Method 1: Use point-slope form to start, then express your answer in slope-intercept form.)

$m = \frac{4-5}{-4-(-2)} = \frac{-1}{-2} = \frac{1}{2}$

$y - y_0 = m(x - x_0)$

$y - y_0 = \frac{1}{2}(x - x_0)$

$y - 5 = \frac{1}{2}(x+2)$ use (-4,4) and check.

$y - 5 = \frac{1}{2}x + 1$

$\boxed{y = \frac{1}{2}x + 6}$

Example: Find the equation of the line that passes through the points (4, 1) and (-2, 4).

(Method 2: Use slope-intercept form.)

$y = mx + b \implies y = -\frac{1}{2}x + b$

$m = \frac{4-1}{-2-4} = \frac{+3}{-6} = \frac{-1}{2}$

$4 = -\frac{1}{2}(-2) + b \implies b = 3$

Horizontal and Vertical Lines:

Find the equations of the lines through the points:

a) (-2, 5) and (-2, -7)

b) (-2, 5) and (-4, 5)

a) $m = \frac{-7-5}{-2-(-2)} = \frac{-12}{0}$ ... undefined slope (vertical line: x-coordinate is always equal to -2; so $x = -2$ is the equation of this line)

b) horizontal line ($m = 0$).

y-coordinate is always 5, so eqn is $y = 5$.

Parallel and Perpendicular Lines:

Definition 1: Two lines are parallel iff they have the same slopes (including vertical lines whose slopes are undefined).

Definition 2: Two nonvertical lines with slopes m_1 and m_2 are perpendicular iff their slopes are opposite reciprocals.

That is, $m_1 = -1/m_2$, or equivalently, $(m_1)(m_2) = -1$

(Also, every vertical line is perpendicular to every horizontal line.)

Ex:

$m_1 = \frac{2}{3}$

$m_2 = -\frac{3}{2} \rightarrow (m_1)(m_2) = \frac{2}{3} \cdot \frac{-3}{2} = -1.$ ✓

Example: Find the equation of a line through (2, -7) that is perpendicular to the line 5x + 2y = 18.

$2y = -5x + 18$

$y = -\frac{5}{2}x + 9$

$m = -\frac{5}{2}.$

Perpendicular line will have slope equal to $+\frac{2}{5}$.

So $y - (-7) = \frac{2}{5}(x-2)$ is the line through $(2, -7)$ with slope $2/5$.

That is, $y + 7 = \frac{2}{5}x - \frac{4}{5}$

or $\boxed{y = \frac{2}{5}x - 7\frac{4}{5}}$