U1 L2 Graphs of Equations

Name: _____ HR: _____

Skills: Sketch graphs, find intercepts, test for symmetry, and write equations of circles.

Warm-Up: Prerequisite Skills

You'll use these three skills constantly in this lesson — make sure they're solid before we start.

1. Evaluating by Substitution

Ex: evaluate y = 2x − 3 when x = −1.

$y(-1) = 2(-1) - 3$
$= -2 - 3$
$= -5$

$(-1, -5)$

Your turn — evaluate $y = x^2 - 4$ when x = 3:

$y(3) = (3)^2 - 4$
$= 9 - 4$
$= 5$

2. The Distance Formula (1.1)

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

Ex: (-4,-1) and (2, 7)

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Your turn — find the distance between (0, 0) and (3, 4):

3. Solving for y

Ex: solve 2x + y = 6 for y.

y = 6 − 2x

Answer
oops

$2x + y = 6$
$-2x \quad -2x$
$y = 6 - 2x$
$y = -2x + 6$

Your turn — solve x − y = 4 for y:

$x - y = 4$
$-x \quad -x$
$-1(-1y) = (-x + 4)(-1)$
$y = x - 4$

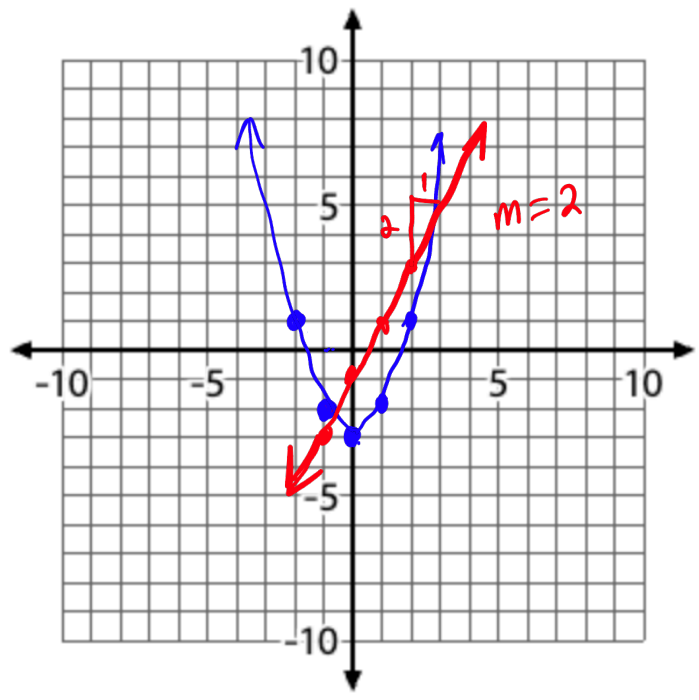
Vocabulary

- solution point — an ordered pair (a, b) that makes an equation true when x = a and y = b
- graph of an equation — the set of all solution points
- intercepts — the points where a graph crosses or touches an axis
- symmetry — x-axis, y-axis, or origin symmetry (see below)
- circle — the set of points a fixed distance r (the radius) from a center (h, k)

Sketching a Graph by Plotting Points

A solution point (a, b) makes the equation true. To sketch a graph:

1. Make a table of x-values.
2. Compute y for each x.
3. Plot the points.
4. Connect with a smooth curve.



Ex: $y = x^2 - 3$

x:	-2	-1	0	1	2
y:	1	-2	-3	-2	1

$y(-2) = (-2)^2 - 3$
$= 4 - 3 = 1$

$y(-1) = (-1)^2 - 3 = 1 - 3 = -2$

$y = mx + b$

You try: y = 2x − 1

x:	-1	0	1	2
y:	-3	-1	1	3

$y(-1) = 2(-1) - 1$
$= -2 - 1$

x- and y-Intercepts

To find x-intercepts: let y = 0, solve for x.

$y = x - 3$
$0 = x - 3$
$+3 \quad +3$
$x = 3$

To find y-intercepts: let x = 0, solve for y.

$y = x - 3$
$y = 0 - 3$
$y = -3$

An x-intercept is written (a, 0). A y-intercept is written (0, b).

$x = 0$

Ex: Find the intercepts of $y = x^3 - 4x$.

x & y

Let y = 0:

cubic — 3 solutions

x-intercepts:

$0 = x^3 - 4x$
$x \cdot x \cdot x \quad -4 \cdot x$

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

$0 = x(x^2 - 4)$
$0 = x(x - 2)(x + 2)$

$x = 0 \quad x - 2 = 0 \quad x + 2 = 0$
$x = 2 \quad x = -2$

Let x = 0:

y-intercept:

$y = 0^3 - 4(0)$
$= 0$

$y = 0$

You try: Find the intercepts of $y = -x^2 - 5x$.

$y = -x^2 - 5x$

x-inter: $(0) = (-x^2 - 5x) \cdot -1$

$0 = x^2 + 5x$

y-int: (0, 0)

$0 = x(x + 5)$

$x = 0 \quad x + 5 = 0$
$x = 0 \quad x = -5$

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Symmetry

Knowing a graph's symmetry means you need only half as many solution points to sketch it.

x-Axis Symmetry

Replace y with −y. If you get an equivalent equation, the graph is symmetric about the x-axis. $x - y^2 = 1$

Check for Symm. over X-AXIS

$x - (-y)^2 = 1$

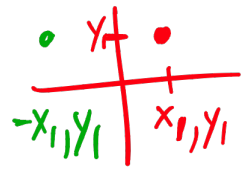
$x - y^2 = 1$

y-Axis Symmetry

Replace x with −x. If you get an equivalent equation, the graph is symmetric about the y-axis. $y = x^2 - 2$

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

$y = x^2 - 2$



Origin Symmetry

Replace x with −x AND y with −y. If you get an equivalent equation, the graph is symmetric about the origin. $x^2 + y^2 = 9$

$(-x)^2 + (-y)^2 = 9$

$x^2 + y^2 = 9$

Symmetric About origin

Ex: Test $y = x^2 - 2$ for symmetry.

X AXIS: Replace y with −y

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

No X-AXIS Symmetry

Y-AXIS: x with −x

$y = (-x)^2 - 2 \rightarrow x^2 - 2$ yes

origin — No

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

$\frac{-y}{-1} = \frac{x^2}{-1} - \frac{2}{-1}$

$y = -x^2 + 2$

You try: Test $y = x^3$ for symmetry.

X: $-y = x^3$ No

$y = -x^3$

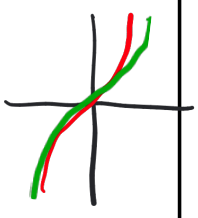
Y: $y = (-x)^3$ | No

$y = -x^3$

$-y = (-x)^3$

$\frac{-y}{-1} = \frac{-x^3}{-1}$

$y = x^3$



A circle is the set of points (x, y) a fixed distance r from a center (h, k). This comes straight from the Distance Formula:

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

Squaring both sides gives the standard form:

$$(x-h)^2 + (y-k)^2 = r^2$$

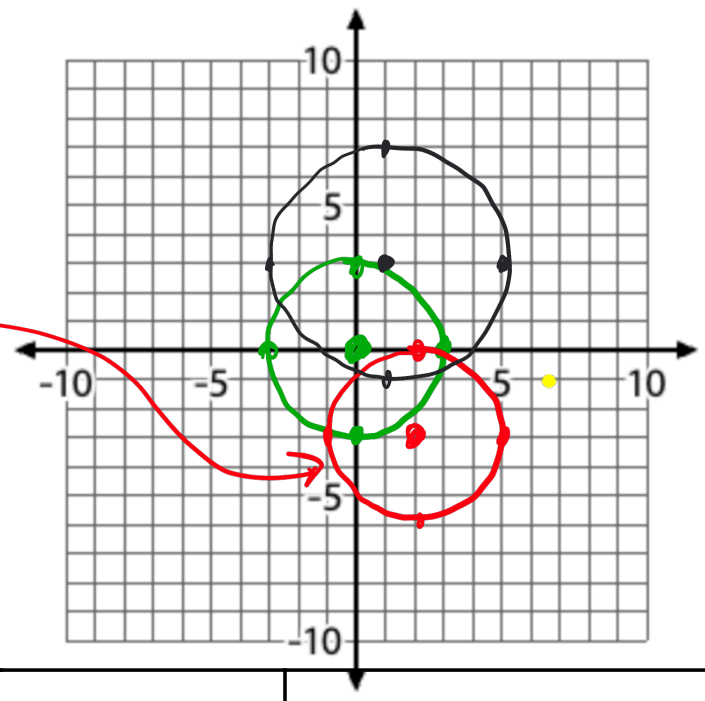
Eq of circle

$(x - 2)^2 + (y + 3)^2 = 9$

$x^2 + y^2 = 9 \quad r^2 = 9 \quad r = 3$

$x^2 + y^2 = r^2$

Circles



Ex: center (1, 3), radius 4

(h, k)

$(x-h)^2 + (y-k)^2 = r^2$

$(x-1)^2 + (y-3)^2 = 4^2$

$(x-1)^2 + (y-3)^2 = 16$

You try: center (0, 0), radius 5

$(x-0)^2 + (y-0)^2 = 25$

$x^2 + y^2 = 25$

Extension: Circle from Center + a Point on It

The point (3, 4) lies on a circle centered at (−1, 2). Use the Distance Formula to find r, then write the standard-form equation.

Application: Maximum Weight

For men in the U.S. Marine Corps, maximum weight y (lb) for height x (in.) is modeled by

$y = 0.040x^2 - 0.11x + 3.9$

Use the model to find y when x = 66.

You try: find y when x = 72.

Section 1.2 Summary — Can you...

☐ Sketch a graph by plotting solution points?

☐ Find the x- and y-intercepts of a graph?

☐ Test an equation for symmetry (3 types)?

☐ Write the standard-form equation of a circle?

☐ Use a graph/model to solve a real-life problem?

Formulas at a Glance — Section 1.2

x-int: let y = 0, solve for x

y-int: let x = 0, solve for y

$(x-h)^2 + (y-k)^2 = r^2$