

Notes

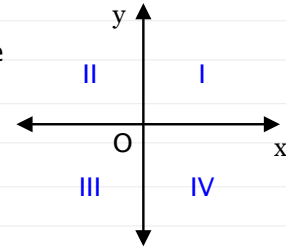
Chapter 13: Coordinate Geometry

Unit 1: Geometry and Algebra

Section 1: The Distance Formula

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Let's review some basic terms you learned in Algebra. Coordinate plane shown is referred as "x-y coordinate plane", "rectangular coordinate plane", or "Cartesian coordinate plane."



13.1

13.5

13.2

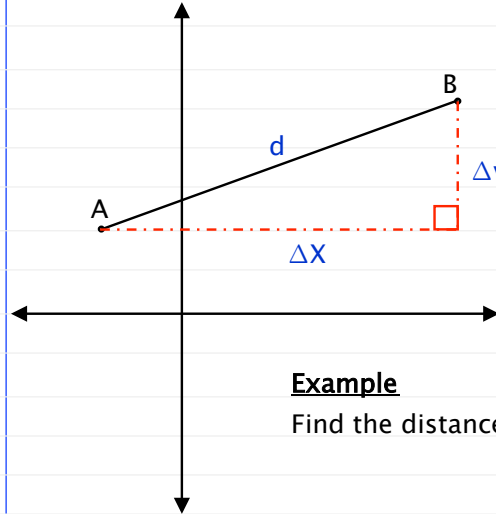
13.3

13.4

13.6

13.7

13.8



Using Pythagorean theorem,

$$d^2 = (\Delta x)^2 + (\Delta y)^2$$

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

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

Example

Find the distance between A(4, -2) and B(1, 2).

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Theorem 13.1 The Distance Formula

The distance between points (x_1, y_1) and (x_2, y_2) is given by:

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

Example 1

Find the distance between the origin and the point names.

(a) (0, -6)

(b) (8, 0)

(c) (7, 24)

Example 2

Find the distance between the points. Write answer in simplest form.

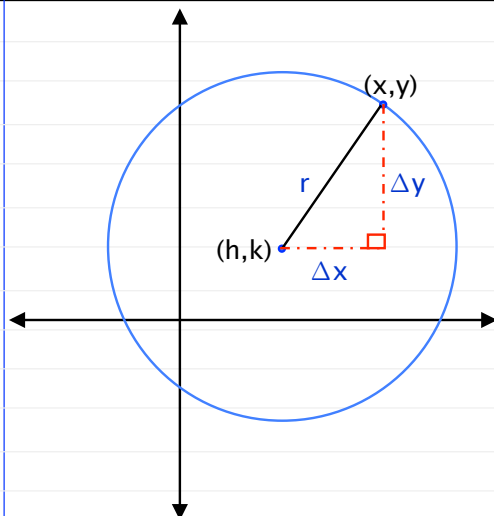
(a) (2, 5), (8, 5)

(b) (-3, -8), (2, 4)

(c) (6, 0), (5, 1)

(e) (9, 4), (1, -8)

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Using Pythagorean theorem,

$$(\Delta x)^2 + (\Delta y)^2 = r^2$$

$$(x_2 - x_1)^2 + (y_2 - y_1)^2 = r^2$$

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Theorem 13.2 The Equation of the CircleAn equation of the circle with center (a, b) and radius r is

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

Example 3

Find the equation of a circle with the given center and radius.

(a) $(4, -3)$, $r = 5$

(b) $(-1, -2)$, $r = \sqrt{3}$

Example 2

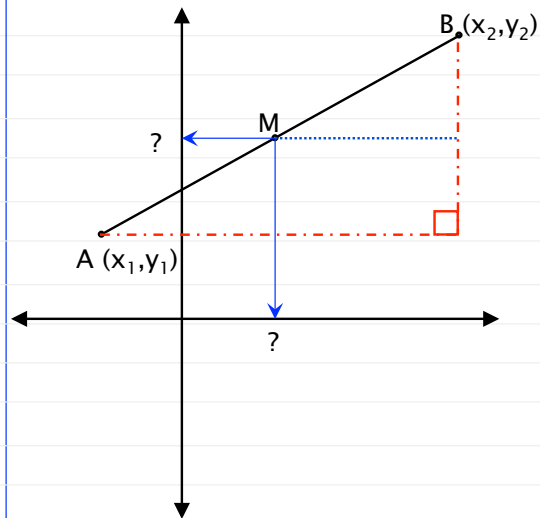
Find the center and radius of each circle.

(a) $(x - 8)^2 + (y - 1)^2 = 64$

(b) $(x + 9)^2 + (y - 7)^2 = 25$

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What do you see?

What is the coordinate of the midpoint M?

How can you prove it?

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Theorem 13.5 The Midpoint FormulaThe midpoint of the segment that joins points (x_1, y_1) and (x_2, y_2) is the point

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

Example 1

Find the midpoint of segment AB.

(a) $A(6, 3)$, $B(-2, -5)$ (b) $A(a, b)$, $B(c, b)$ **Example 2**

$M(4, -2)$ is the midpoint of the segment AB. If A has coordinates $(2, -5)$,
 find the coordinate of B.

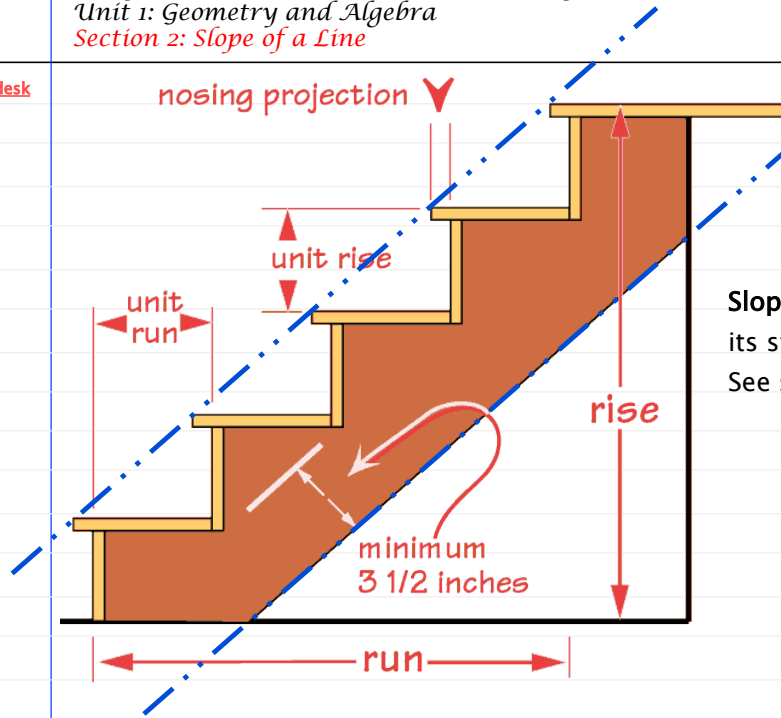
$$(x + 9)^2 + (y - 7)^2 = 25$$

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Section 2: Slope of a Line

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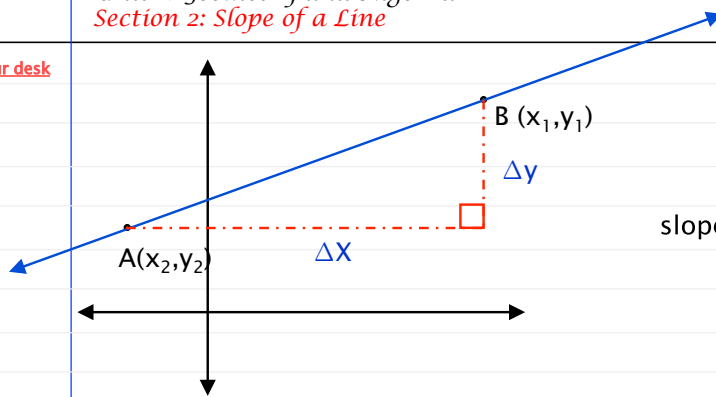


Slope of a line indicates its steepness. See stairs, for example.

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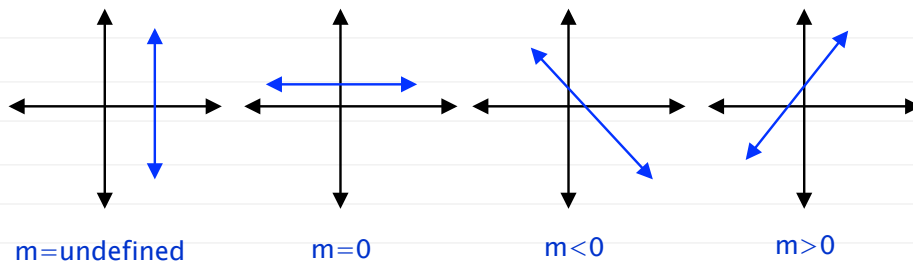
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$$\begin{aligned} \text{slope } m &= \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} \\ &= \frac{y_2 - y_1}{x_2 - x_1} \end{aligned}$$

Type of slopes:



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Example 1

Always, sometimes, or never.

- a) The slope of a vertical line is _____ zero.
- b) The slope of a horizontal line is _____ zero.
- c) The slope of a line that rises to the right is _____ positive.
- d) The slope of a line that falls to the right is _____ negative.

Example 2

Find the slope of the line through the two points names.

- 1. (-3,4), (-4,5)
- 2. (6,-3), (-1,-2)
- 3. (8,-4), (-3,-4)
- 4. (-6,-2), (-6,9)

Now find the distance between the two points named!!

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Theorem 13.3

Two non-vertical lines are parallel if and only if their slopes are equal.
What can you conclude about two vertical lines?

Theorem 13.4

Two non-vertical lines are perpendicular if and only the product of their slope is -1 .
What can you conclude about a horizontal line and a vertical line?

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Example 1

Complete the table below for $r \parallel s$ and $r \perp t$.

	slope of r	slope of s	slope of t
a	$-1/2$		
b			$1/6$
c		$1/5$	
d		-4	
e			a
f			$3b/4$

Example 2

If $r \parallel s$ and r is a horizontal line, what is the slope of s?

Example 3

If $k \perp n$, and n has slope 0, what is the slope of k?

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Example 4

Use slopes to show that a quadrilateral with vertices A(-2,7), B(3,7), C(6,11), and D(1,11) is a parallelogram.

Example 5

Plot points A(4,0), B(0,-8), and C(-16,0). Classify the triangle ABC.

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Chapter 13: Coordinate Geometry

Unit 2: Lines and Coordinate Proofs

Section 6: Graphing Linear Equations

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Theorem 13.6 Standard Form (otherwise known as General Form)

The graph of any equation that can be written in the form

$$Ax+By=C$$

where A and B are not both zero, is a line.

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Theorem 13.7 Slope-Intercept Form

A line with the equation $y=mx+b$ has slope m and y-intercept b.

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Example 4

Use slopes to show that a quadrilateral with vertices $A(-2,7)$, $B(3,7)$, $C(6,11)$, and $D(1,11)$ is a parallelogram.

Example 5

Plot points $A(4,0)$, $B(0,-8)$, and $C(-16,0)$. Classify the triangle ABC .