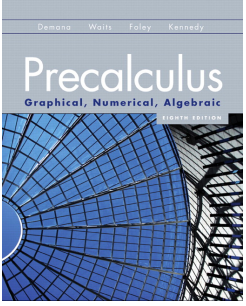


P.2

Cartesian Coordinate System



PEARSON
Addison Wesley

Copyright © 2011 Pearson, Inc.

What you'll learn about

- Cartesian Plane
- Absolute Value of a Real Number
- Distance Formulas
- Midpoint Formulas
- Equations of Circles
- Applications

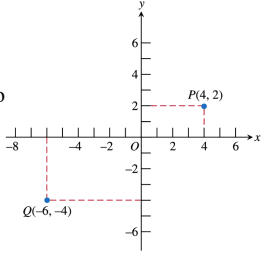
... and why

These topics provide the foundation for the material that will be covered in this textbook.

Copyright © 2011 Pearson, Inc. Slide P.2 - 2

The Cartesian Coordinate Plane or Rectangular Coordinate System

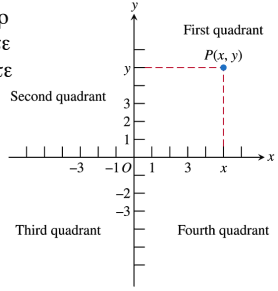
ξ-αξισ
ψ-αξισ
οριγιν
ορδερεδ παιρ



Copyright © 2011 Pearson, Inc. Slide P.2 - 3

Quadrants

ορδερεδ παιρ
ξ-χοορδινατε
ψ-χοορδινατε



Copyright © 2011 Pearson, Inc. Slide P.2 - 4

Absolute Value of a Real Number

The **absolute value** of a real number a is

$$|a| = \begin{cases} a, & \text{if } a > 0 \\ -a, & \text{if } a < 0. \\ 0, & \text{if } a = 0 \end{cases}$$

Copyright © 2011 Pearson, Inc. Slide P.2 - 5

Example Using the Definition of Absolute Value

Evaluate:

$$|-7|$$

$$|\pi - 5|$$

Copyright © 2011 Pearson, Inc. Slide P.2 - 6

Solution

Evaluate:

$$|-7| = 7$$

because $-7 < 0$, $|-4| = -(-7) = 7$

$$|\pi - 5| = -(\pi - 5) = 5 - \pi$$

because $\pi \approx 3.14$, $\pi - 5 < 0$

Copyright © 2011 Pearson, Inc. Slide P.2 - 7

Properties of Absolute Value

Let a and b be real numbers.

- $|a| \geq 0$
- $|-a| = |a|$
- $|ab| = |a||b|$
- $\left|\frac{a}{b}\right| = \frac{|a|}{|b|}$, $b \neq 0$

Copyright © 2011 Pearson, Inc. Slide P.2 - 8

Distance Formula (Number Line)

Let a and b be real numbers.
 The **distance between a and b** is $|a - b|$.

Note that $|a - b| = |b - a|$.

Copyright © 2011 Pearson, Inc. Slide P.2 - 9

Distance Formula (Coordinate Plane)

The **distance d between points $P(x_1, y_1)$ and $Q(x_2, y_2)$** in the coordinate plane is

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

Copyright © 2011 Pearson, Inc. Slide P.2 - 10

The Distance Formula using the Pythagorean Theorem

Copyright © 2011 Pearson, Inc. Slide P.2 - 11

Example Finding the Distance Between Two Points

Βρειτε την απόσταση d μεταξύ των σημείων $(2, 7)$ και $(5, 3)$.

Copyright © 2011 Pearson, Inc. Slide P.2 - 12

Solution

Φινδ τηδ διστανχε δ βετωεεν τηε ποινησ (2, 7) ανδ (5, 3).

$$\begin{aligned}d &= \sqrt{(2-5)^2 + (7-3)^2} \\ &= \sqrt{(-3)^2 + (4)^2} \\ &= \sqrt{9+16} \\ &= \sqrt{25} \\ &= 5\end{aligned}$$

Copyright © 2011 Pearson, Inc.

Slide P.2 - 13

Midpoint Formula (Number Line)

The **midpoint** of the line segment with endpoints a and b is

$$\frac{a+b}{2}.$$

Copyright © 2011 Pearson, Inc.

Slide P.2 - 14

Midpoint Formula (Coordinate Plane)

The **midpoint** of the line segment with endpoints (a,b) and (c,d) is

$$\left(\frac{a+c}{2}, \frac{b+d}{2} \right).$$

Copyright © 2011 Pearson, Inc.

Slide P.2 - 15

Standard Form Equation of a Circle

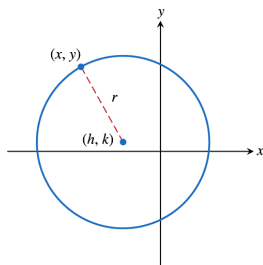
The **standard form equation** of a circle with center (h,k) and radius r is

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

Copyright © 2011 Pearson, Inc.

Slide P.2 - 16

Standard Form Equation of a Circle



Copyright © 2011 Pearson, Inc.

Slide P.2 - 17

Example Finding Standard Form Equations of Circles

Find the standard form equation of the circle with center $(2, -3)$ and radius 4.

Copyright © 2011 Pearson, Inc.

Slide P.2 - 18

Example Finding Standard Form Equations of Circles

Find the standard form equation of the circle with center $(2, -3)$ and radius 4.

$$(x - h)^2 + (y - k)^2 = r^2 \quad \text{where } h = 2, k = -3, \text{ and } r = 4.$$

Thus the equation is $(x - 2)^2 + (y + 3)^2 = 16$.

Copyright © 2011 Pearson, Inc.

Slide P.2 - 19

Quick Review

1. Find the distance between $-\frac{5}{4}$ and $\frac{3}{2}$.

Use a calculator to evaluate the expression. Round answers to two decimal places.

2. $\sqrt{8^2 + 6^2}$

3. $\frac{-12 + 8}{2}$

4. $\sqrt{3^2 + 5^2}$

5. $\sqrt{(2-5)^2 + (1-3)^2}$

Copyright © 2011 Pearson, Inc.

Slide P.2 - 20

Quick Review Solutions

1. Find the distance between $-\frac{5}{4}$ and $\frac{3}{2}$. **2.75**

Use a calculator to evaluate the expression. Round answers to two decimal places.

2. $\sqrt{8^2 + 6^2}$ **10**

3. $\frac{-12 + 8}{2}$ **-2**

4. $\sqrt{3^2 + 5^2}$ **5.83**

5. $\sqrt{(2-5)^2 + (1-3)^2}$ **3.61**

Copyright © 2011 Pearson, Inc.

Slide P.2 - 21