Distance Formula: 

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

Plug in the example

$$d = \sqrt{(5-2)^2 + (1-5)^2}$$

$$= \sqrt{(3)^2 + (-4)^2}$$

$$= \sqrt{9 + 16}$$

$$= \sqrt{25} = 5$$

Midpoint Formula: used for midpoint of line segments.

$$\text{Midpoint} = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right) = \left(\frac{2+5}{2}, \frac{5+1}{2}\right) = \left(\frac{7}{2}, \frac{3}{2}\right)$$

or

$$= (3.5, 3)$$
Concepts You Will See on the Third Test

P.6 Rectangular Coordinate System

Details of the RCS

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

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

Pythagorean Theorem \( (a^2 + b^2 = c^2) \) and its applications

1.1 Graphs of Equations

Finding the x- and y-intercept

Determining if a point is on a line

Using the Standard Form of a Circle \( (x - h)^2 + (y - k)^2 = r^2 \) to find center and radius and vice versa

Finding the equation of a circle when given the endpoints of a diameter

1.2 Solving Linear Equations

Examples of equations with one, no or all solutions

Equations involving Fractions

\[ \text{Fraction} = \frac{\text{numerator}}{\text{denominator}}; \text{Cross Multiply} \]

Multiple Fractions; 1) Find LCM of denominators; 2) Multiply all terms by that LCM

1.3 Word Problems

Percentages \( \left( \frac{\text{is}}{\text{of}} = \% \right) \); Finances; Averaging Grades; Measuring \( \left( \frac{\text{object}_1}{\text{shadow}_1} = \frac{\text{object}_2}{\text{shadow}_2} \right) \)

Remember to use the same units in each fraction!

1.4 Solving Quadratic Equations

Solving by: 1) Factoring Method; 2) The Square Root Method; 3) The Quadratic Formula

The Discriminant: 1) Finding the Discriminant \( (b^2 - 4ac) \); 2) Determining its implications (is it positive, negative or zero?)
Pythagorean Theorem: \( a^2 + b^2 = c^2 \)

\[
(20)^2 + (15)^2 = c^2 \\
400 + 225 = c^2 \\
c^2 = 625 \\
\sqrt{c^2} = \sqrt{625} \\
c = 25
\]

\[2x + 3y = 12\]

**Intercepts**

**x-intercept:** (Let \( y = 0 \) and solve for \( x \))

\[
2x + 3(0) = 12 \\
2x = 12 \\
x = 6 \quad \text{(6,0)}
\]

**y-intercept:** (Let \( x = 0 \) and solve for \( y \))

\[
2(0) + 3y = 12 \\
3y = 12 \\
y = 4 \quad \text{(0,4)}
\]
Is a point on a line: \( \text{Ex:} \) Is \((1, 5)\) on \(2x + 3y = 12\)

\[
2(1) + 3(5) = 12
\]

\[
2 + 15 = 17 \neq 12 \quad \text{So } (1, 5) \text{ is not on the line.}
\]

Circles:

\(\text{Ex:}\)

Center: \((5, 2)\)

Radius: \(7\)

So, the standard form of the circle is \((x-5)^2 + (y-2)^2 = 7^2\)

\(\text{Ex:}\) If \((x+2)^2 + y^2 = 64\)

Center: \((-2, 0)\)

Radius: \(\sqrt{64} = 8\)

\(\text{Ex:}\) \((2, 1), (6, 3)\) are the endpoints of a diameter of the circle

1) Midpoint \(= \text{center}\)

\[
\left( \frac{2+6}{2}, \frac{1+3}{2} \right) = \left( \frac{8}{2}, \frac{4}{2} \right) = (4, 2)
\]

2) Distance \(= \text{radius}\)

\[
d = \sqrt{(6-4)^2 + (3-2)^2} = \sqrt{(2)^2 + (1)^2} = \sqrt{5}
\]

Center: \((4, 2)\)

Radius: \(\sqrt{5}\)

\((x-4)^2 + (y-2)^2 = 5\)
\[ \frac{3x - 5}{2x - 1} = \frac{4}{5} \Rightarrow (3x - 5)(5) = (2x - 1)(4) \]
\[ 15x - 25 = 8x - 4 \]
\[ -8x + 25 = -8x + 25 \]
\[ \frac{7x}{7} = \frac{21}{7} \]
\[ x = 3 \]

**Example:**
\[ 7 + \frac{x}{4} = 9 + \frac{x}{6} \]

1) **LCM is 12**
2) **Multiply all terms by LCM**

\[ 7 \cdot 12 + \frac{12 \cdot x}{4} = 9 \cdot 12 + \frac{12 \cdot x}{6} \]
\[ 84 + \frac{12 \cdot x}{4} = 108 + \frac{12 \cdot x}{6} \]
\[ -84 - x = -84 - x \]
\[ x = 16 \]

**Example:**
\[ 78 \text{ is what } \% \text{ of } 200? \]
\[ \left( \frac{18}{200} = \frac{\%}{100} \right) \]
\[ \frac{78}{200} = \frac{x}{100} \]
\[ 78 = 200 \cdot x \]
\[ \frac{7800}{200} = 200 \cdot \frac{x}{200} \]
\[ x = 39 \]
Ex:

Thing 1 is \( x \) ft tall and costs a 8 ft shadow.

Thing 2 is 5 yards tall and costs a 2 ft shadow.

\[
\frac{x \text{ ft}}{8 \text{ ft}} = \frac{5 \text{ yards}}{2 \text{ ft}}
\]

\[
\frac{x \text{ ft}}{8 \text{ ft}} = \frac{15 \text{ ft}}{2 \text{ ft}}
\]

\[
\frac{x}{8} = \frac{15}{2}
\]

\[
2x = 5 \cdot 15
\]

\[
\frac{2x}{2} = \frac{75}{2}
\]

\[
x = \frac{37.5}{2}
\]

Ex:

\[
x^2 + 13x + 42 = 0
\]

\[
(x + 6)(x + 7) = 0
\]

\[
x + 6 = 0 \quad x + 7 = 0
\]

\[
x = -6 \quad x = -7
\]

Ex:

\[
4x^2 - 25 = 0
\]

\[
4x^2 = 25
\]

\[
2x = \pm 5
\]

\[
x = \pm \frac{5}{2}
\]
\[ x^2 + 5x + 2 = 0 \]
\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-5 \pm \sqrt{(-5)^2 - 4(1)(2)}}{2(1)} \]
\[ = -5 \pm \frac{\sqrt{25 - 8}}{2} \]
\[ = -5 \pm \frac{\sqrt{17}}{2} \]

**Discriminant:** \( b^2 - 4ac \)