*MAC 1105* | *Distance and Midpoint Formulas* | *Instr: Jamieson*

*Chap 1 Sec 2* | *Last updated 1/27/2012*

**Exercises**: The numbers in the test problems will probably be simpler, but the format will be the same.

**1.** Find the exact distance between $\left(\frac{2}{5},\frac{4}{3}\right)$ and $\left(\frac{4}{3},\frac{3}{2}\right)$.

**a**. $\sqrt{\frac{253}{300}}$ **b**. $\sqrt{\frac{475}{250}}$ **c.** $\sqrt{\frac{253}{150}}$ **d.** $\sqrt{\frac{243}{300}}$

**ae.** $\sqrt{\frac{257}{300}}$ **be.** $\sqrt{\frac{253}{30}}$ **ce.** $\sqrt{\frac{253}{200}}$ **de.** $\sqrt{\frac{153}{300}}$

**2.** Find the distance between (2,3) and (5,-4). Round to the nearest thousandth.

**a.** 7.612 **b**. 7.614 **c**. 7.616 **d**. 7.618

**ae**. 7.620 **be**. 7.622 **ce**. 7.624 **de**. 7.626

**3.** Find the exact midpoint of the line segment between (1,7) and (3,-2)

**a**. $\left(2,\frac{5}{2}\right)$ **b**. $\left(2,\frac{3}{2}\right)$ **c**. $\left(2,\frac{5}{4}\right)$ **d**. $\left(\frac{2}{3},\frac{5}{2}\right)$

**ae**. $\left(\frac{2}{7},\frac{5}{2}\right)$ **be**. $\left(2,\frac{1}{2}\right)$ **ce**. $\left(\frac{2}{3},\frac{3}{2}\right)$ **de**. $\left(\frac{2}{7},\frac{1}{2}\right)$

**4.** Find the exact midpoint of the line segment between (-2,7) and (5,2). Round to the nearest hundredth.

**a**. (1.5,4.5) **b**. (2.5,4.5) **c**. (1.5,5.5) **d**. (2.5,5.5)

**ae**. (1.5,2.5) **be**. (2.5,3.5) **ce**. (1.5,2.5) **de**. (1.5,3.5)

**Answers**:

**1.** $\sqrt{\left(\frac{4}{3}-\frac{2}{5}\right)^2+\left(\frac{3}{2}-\frac{4}{3}\right)^2}=\sqrt{\left(\frac{5\cdot4-2\cdot3}{3\cdot5}\right)^2+\left(\frac{3\cdot3-2\cdot4}{2\cdot3}\right)^2}=\sqrt{\left(\frac{14}{15}\right)^2+\left(\frac{1}{6}\right)^2}$

$=\sqrt{\left(\frac{14}{15}\right)^2+\left(\frac{1}{6}\right)^2}=\sqrt{=\sqrt{\left(\frac{14}{15}\right)^2+\left(\frac{1}{6}\right)^2}}=\sqrt{\frac{6831}{8100}}=\sqrt{\frac{253}{300}}$ **a.**

**2.** $\sqrt{(5-2)^2+(-4-3)^2}=\sqrt{9+49}=\sqrt{58}\approx7.61577$ **c**.

**3. a**

**4.** **.a**

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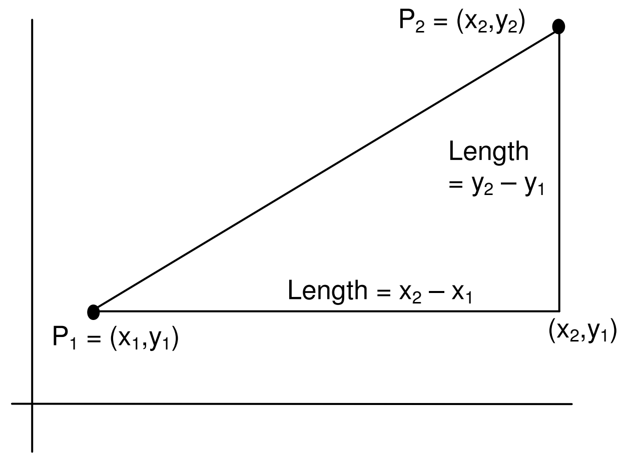
# *Explanations – why do these computations work?*

## ***Distance***

When we have two points in the xy-plane as shown. The Pythagorean Theorem tells us that the distance between the points (the length of the hypotenuse) is given by $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.




Because $x_1 - x_2 = -(x_2 - x_1)$ and $(x_1 - x_2)^2 = (x_2 - x_1)^2$, there are several ways to calculate this value if you want to avoid subtracting a negative number from another negative number.

**Ex 1**: Find the exact distance between (1,7) and (4,12).

**Soln**: The correct answer is $\sqrt{(4-1)^2 + (12-7)^2} = \sqrt{34}$.

$\sqrt{34} \approx 5.830951895...$ is *not* correct because it is not *exact*.

## ***Midpoint***

The midpoint of the line segment between $P_1 = (x_1,y_1)$ and $P_2 = (x_2,y_2)$ is found by averaging the x-coordinates and averaging the y-coordinates. So $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$. There is also a geometrical derivation of this, which uses proportional triangles associated with lines transecting three parallel lines. The idea of averaging is simpler.