Assignment 0

Thursday, January 22, 2015

In your mathematical careers, it will be increasingly more important for you to demonstrate good problem solving skills. The emphasis is shifting from being able to grind out rote calculations like you did in Algebra, to being able to solve original problems. And part of problem solving is being able to explain to others how you solved the problem. For that reason, your homework will be graded on how much work you show, and how much you explain your reasoning. The following is a sample problem along with several different possible student responses. Each response is graded, and the grade for each is explained.

1. Find the distance between the points $(-1, 3)$ and $(2, -1)$.

Solution 1 : 16
Grade : 0 out of 5 points
Explanation : The answer is incorrect, and no work is shown.

Solution 2 : 5
Grade : 1 out of 5 points
Explanation : Although the answer is correct, there is no indication by the student how he or she obtained the answer.

Solution 3 : $\sqrt{(-1-2)^2 + (3-(-1))^2} = 5$.
Grade : 2 out of 5 points
Explanation : The student here employed the correct formula (distance formula) and obtained the correct answer. However, unless the reader knows exactly what to do, he or she will have no idea why a square root is calculated, and why the individual components are placed the way that they are. A good rule to follow is that you should never start a sentence with an equation.

Solution 4 : To find the distance between two points (x_1, y_1) and (x_2, y_2), we use the distance formula, which is

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

So, the distance between $(-1, 3)$ and $(2, -1)$ is

$$\begin{aligned} d &= \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \\ &= \left(\frac{-1 + 2}{2}, \frac{3 + (-1)}{2} \right) \\ &= \left(\frac{1}{2}, 1 \right). \end{aligned}$$

Grade : 2 out of 5 points

Explanation : The student here has a nicely written solution, but to a completely different problem. He or she used the midpoint formula instead of the distance formula. The work flows nicely and each step is explained in sufficient detail. A reader will have no problem following the steps and finding the mistake in the problem. In this case, the mistake is relatively serious, so only 2 points are given. Notice that this student gets more points than the student who submitted Solution 2!

Solution 5 : To find the distance between two points (x_1, y_1) and (x_2, y_2), we use the distance formula, which is

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

So, the distance between $(-1, 3)$ and $(2, -1)$ is

$$\begin{aligned} d &= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \\ &= \sqrt{(-1 - 2)^2 + (3 - 1))^2} \\ &= \sqrt{(7)^2 - 2^2} \\ &= \sqrt{15} \end{aligned}$$

Grade : 3 out of 5 points
Explanation : The student here has a nicely written solution, and employs the correct method for the problem. The work flows nicely and each step is explained in sufficient detail. However, the student was extremely careless in carrying out the calculations, and made several mistakes. But since the student wrote out such a nice solution, a reader will have no problem following the steps and identifying the mistakes. Notice that this student gets more points than the student who submitted Solution 2!

Solution 6 : To find the distance between two points (x_1, y_1) and (x_2, y_2), we use the distance formula, which is

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

So, the distance between $(-1, 3)$ and $(2, -1)$ is

$$\begin{aligned} d &= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \\ &= \sqrt{(-1 - 2)^2 + (3 - 1))^2} \\ &= \sqrt{(-3)^2 + 2^2} \\ &= \sqrt{13} \end{aligned}$$

Grade : 4 out of 5 points
Explanation : The student here has a nicely written solution, and employs the correct method for the problem. The work flows nicely and each step is explained in sufficient detail. A reader will have no problem following the steps

and identifying the mistake, which is an omitted minus sign. This is a minor error, and so the student earned most of the points for this problem.

Solution 7 : To find the distance between two points (x_1, y_1) and (x_2, y_2), we use the distance formula, which is

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

So, the distance between $(-1, 3)$ and $(2, -1)$ is

$$\begin{aligned} d &= \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2} \\ &= \sqrt{(-1 - 2)^2 + (3 - (-1))^2} \\ &= \sqrt{(-3)^2 + 4^2} \\ &= 5 \end{aligned}$$

Grade : 5 out of 5 points
Explanation : The student here has a nicely written solution, employs the correct method for the problem, and executes the computations perfectly. The work flows nicely and each step is explained in sufficient detail. A reader will have no problem following the steps and recognizing that the student understands the process for this particular problem. The student earns full credit for this problem.