Finding Distance with the Pythagorean Theorem

Investigate mistakes and missing measures

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

Between (x_1, y_1) and (x_2, y_2), horizontal and vertical changes are $\Delta x = x_2 - x_1$ and $\Delta y = y_2 - y_1$. These form perpendicular legs, so $d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$. Subtract negative coordinates carefully. A horizontal or vertical segment needs only one absolute difference. Multiply the final grid distance by the map scale, and round only the final length.

Worked example

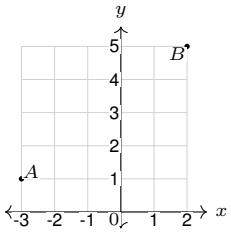
Find the distance from $E(-2, 1)$ to $F(3, 4)$. Give an exact value; round nonintegers to the nearest tenth.

1. The coordinate changes are $\Delta x = 3 - (-2) = 5$ and $\Delta y = 4 - (1) = 3$. They form perpendicular legs on the grid.
2. At 1 units per grid step, $d^2 = 1^2[(5)^2 + (3)^2] = 34$ square units. This scales both perpendicular lengths before squaring.
3. Take the positive root: $d = \sqrt{34} \approx 5.8$ units. Negative coordinate changes do not make the distance negative; round only this final length.
Answer: $\sqrt{34} \approx 5.8$ units

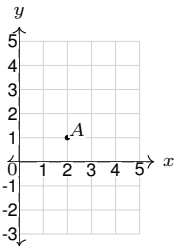
Practice Problems

Show your thinking.

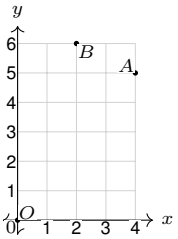
1. A student says the distance from $(-3, 1)$ to $(2, 5)$ is $5 + 4 = 9$. Find the correct distance to the nearest tenth.



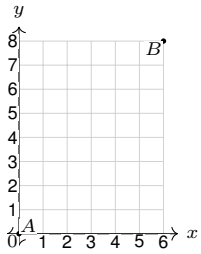
2. Find and plot both $B(5, y)$ if $A(2, 1)$ and B are 5 units apart.



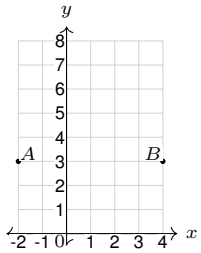
3. Which point is closer to $O(0, 0)$: $A(4, 5)$ or $B(2, 6)$? Compare exact squares.



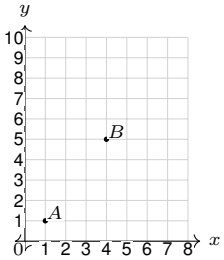
4. Map segment $A(0, 0)$ to $B(6, 8)$ represents 25 m. Find meters per grid step.



5. Shift $A(-2, 3), B(4, 3)$ up 5. Plot the new points and find their distance.



6. Double coordinates of $A(1, 1), B(4, 5)$. Plot the images and correct a predicted distance of 25.



Answer Key

1. $\sqrt{41} \approx 6.4$ units
2. $B = (5, 5)$ or $(5, -3)$
3. B is closer.
4. 2.5m per grid step
5. $A\prime = (-2, 8), B\prime = (4, 8)$; 6 units.
6. $A\prime = (2, 2), B\prime = (8, 10)$; 10 units.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The perpendicular changes are $2 - (-3) = 5$ and $5 - 1 = 4$. The sum 9 is an axis-aligned route, not the direct segment.

2. The direct distance is $d = \sqrt{5^2 + 4^2} = \sqrt{41} \approx 6.4$ units.

3. Since $6.4 < 9$, the straight segment is shorter than the two-leg route, as expected.

Problem 2

1. The horizontal change is $5 - 2 = 3$, so $3^2 + (y - 1)^2 = 25$.

2. Subtract 9: $(y - 1)^2 = 16$. Thus $y - 1 = 4$ or $y - 1 = -4$.

3. The solutions $y = 5, -3$ give points $(5, 5), (5, -3)$. Both distances are $\sqrt{9 + 16} = 5$ units; plot both possible points.

Problem 3

1. The first squared distance is $OA^2 = 4^2 + 5^2 = 16 + 25 = 41$.

2. The second is $OB^2 = 2^2 + 6^2 = 4 + 36 = 40$. Since $40 < 41$, $OB < OA$.

3. The closer point is B. Both distances round to 6.4 to the nearest tenth, so early rounding would hide the difference.

Problem 4

1. The grid distance is $\sqrt{6^2 + 8^2} = \sqrt{100} = 10$ grid steps.

2. The scale is $25/10 = 2.5\text{m}$ per grid step.

3. Check $10(2.5) = 25\text{m}$. Scaling both legs gives $15\text{m}, 20\text{m}$, whose direct separation is $\sqrt{225 + 400} = 25\text{m}$.

Problem 5

1. The new points are $(-2, 3 + 5) = (-2, 8)$ and $(4, 3 + 5) = (4, 8)$.

2. The new distance is $\sqrt{(4 - (-2))^2 + (8 - 8)^2} = \sqrt{36} = 6$ units.

3. The original distance was $4 - (-2) = 6$ units. Equal shifts keep the vertical difference 0, so distance is unchanged.

Problem 6

1. The images are $(2, 2)$ and $(8, 10)$, with changes $8 - 2 = 6$ and $10 - 2 = 8$.

2. The new distance is $\sqrt{6^2 + 8^2} = \sqrt{100} = 10$ units.

3. The original distance was $\sqrt{3^2 + 4^2} = 5$. Distance doubles to 10, not 25; squared distance grows by 4.

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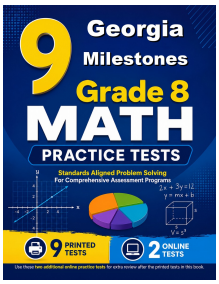

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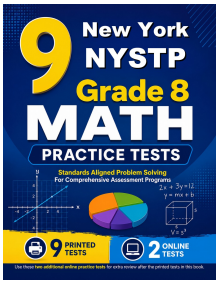

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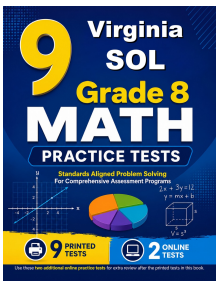

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