Distance with the Pythagorean Theorem

Name: _____	Date: _____	Score: _____ / 24

Quick Review

To find the distance between two points on the coordinate plane, picture a right triangle: the *horizontal* change is one leg and the *vertical* change is the other leg, and the distance you want is the **hypotenuse**. The **distance formula** comes straight from the Pythagorean Theorem: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Find how far apart the x-values are, find how far apart the y-values are, square both, add, and take the square root. The order of subtraction doesn't matter because you square the result anyway.

◇ **Example:** Find the distance between $A(1, 2)$ and $B(4, 6)$.

⇒ Think of a right triangle connecting the two points. The horizontal leg is the change in x: $4 - 1 = 3$. The vertical leg is the change in y: $6 - 2 = 4$. Now use the Pythagorean Theorem: $d = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$. The two points are 5 units apart.

Answer: $d = 5$

PRACTICE

Find the distance between the two points.

1. $(0, 0)$ and $(3, 4)$ _____
2. $(0, 0)$ and $(6, 8)$ _____
3. $(0, 0)$ and $(5, 12)$ _____
4. $(0, 0)$ and $(9, 12)$ _____
5. $(1, 1)$ and $(4, 5)$ _____
6. $(2, 3)$ and $(10, 9)$ _____
7. $(-2, -3)$ and $(1, 1)$ _____
8. $(-3, -2)$ and $(9, 3)$ _____
9. $(3, 4)$ and $(15, 9)$ _____
10. $(-1, 4)$ and $(5, -4)$ _____
11. $(-4, -1)$ and $(4, 5)$ _____
12. $(2, -3)$ and $(10, 3)$ _____
13. $(0, 0)$ and $(8, 15)$ _____
14. $(1, 2)$ and $(8, 26)$ _____
15. $(5, 5)$ and $(5, 12)$ _____
16. $(-3, 4)$ and $(6, 4)$ _____
17. $(0, 0)$ and $(2, 2)$ _____
18. $(1, 1)$ and $(4, 2)$ _____
19. $(-2, 1)$ and $(1, 5)$ _____
20. $(6, 2)$ and $(2, -1)$ _____

Word Problems

21. On a city map, the library is at $(2, 3)$ and the school is at $(10, 9)$, where each unit is one block. How many blocks apart are they in a straight line? _____

22. A drone takes off from $(0, 0)$ on a grid and lands at $(9, 12)$, where each unit is 1 meter. How far did it travel in a straight line? _____

23. Two ships are tracked on a radar grid. One is at $(-3, -2)$ and the other at $(9, 3)$, with each unit equal to 1 nautical mile. How far apart are the ships? _____

24. A hiker walks from a trailhead at $(1, 2)$ to a lookout at $(8, 26)$ on a map where each unit is 100 feet. What is the straight-line distance in feet? _____

Answer Keys

1. 5
2. 10
3. 13
4. 15
5. 5
6. 10
7. 5
8. 13
9. 13
10. 10
11. 10
12. 10
13. 17
14. 25
15. 7
16. 9
17. $2\sqrt{2}$
18. $\sqrt{10}$
19. 5
20. 5
21. 10 blocks
22. 15 meters
23. 13 nautical miles
24. 2500 feet

Step-by-Step Explanations

1. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.
2. Legs 6 and 8: $\sqrt{36+64} = \sqrt{100} = 10$.
3. Legs 5 and 12: $\sqrt{25+144} = \sqrt{169} = 13$.
4. Legs 9 and 12: $\sqrt{81+144} = \sqrt{225} = 15$.
5. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.
6. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.
7. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.
8. Legs 12 and 5: $\sqrt{144+25} = \sqrt{169} = 13$.
9. Legs 12 and 5: $\sqrt{144+25} = \sqrt{169} = 13$.
10. Legs 6 and 8: $\sqrt{36+64} = \sqrt{100} = 10$.
11. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.
12. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.
13. Legs 8 and 15: $\sqrt{64+225} = \sqrt{289} = 17$.
14. Legs 7 and 24: $\sqrt{49+576} = \sqrt{625} = 25$.
15. Same x, so the distance is just the vertical change: $12 - 5 = 7$.
16. Same y, so the distance is the horizontal change: $6 - (-3) = 9$.
17. Legs 2 and 2: $\sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$.
18. Legs 3 and 1: $\sqrt{9+1} = \sqrt{10}$.
19. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.
20. Legs 4 and 3: $\sqrt{16+9} = \sqrt{25} = 5$.
21. The horizontal change is 8 and the vertical change is 6, so the distance is $\sqrt{8^2+6^2} = \sqrt{100} = 10$ blocks.
22. The legs are 9 and 12, so the straight-line distance is $\sqrt{9^2+12^2} = \sqrt{225} = 15$ m.
23. The horizontal change is 12 and the vertical change is 5, so the distance is $\sqrt{12^2+5^2} = \sqrt{169} = 13$ nautical miles.
24. The legs are 7 and 24, so the grid distance is $\sqrt{49+576} = \sqrt{625} = 25$ units. Each unit is 100 ft, so that is $25 \times 100 = 2500$ ft.

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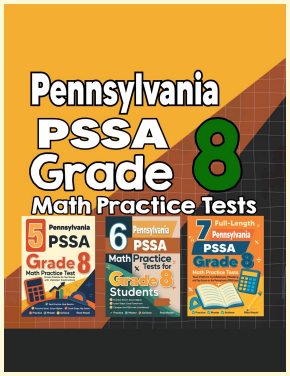

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