

Distance with the Pythagorean Theorem

Name: _____ Date: _____ Score: _____ / 24

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

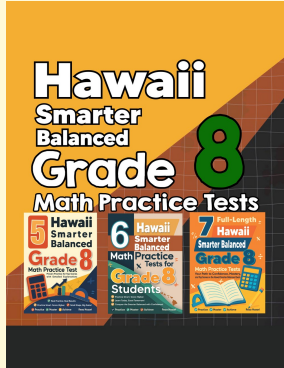
- | | |
|-------------------------------------|--|
| 1. <input type="text" value="5"/> | 13. <input type="text" value="17"/> |
| 2. <input type="text" value="10"/> | 14. <input type="text" value="25"/> |
| 3. <input type="text" value="13"/> | 15. <input type="text" value="7"/> |
| 4. <input type="text" value="15"/> | 16. <input type="text" value="9"/> |
| 5. <input type="text" value="5"/> | 17. <input type="text" value="2√2"/> |
| 6. <input type="text" value="10"/> | 18. <input type="text" value="√10"/> |
| 7. <input type="text" value="5"/> | 19. <input type="text" value="5"/> |
| 8. <input type="text" value="13"/> | 20. <input type="text" value="5"/> |
| 9. <input type="text" value="13"/> | 21. <input type="text" value="10 blocks"/> |
| 10. <input type="text" value="10"/> | 22. <input type="text" value="15 meters"/> |
| 11. <input type="text" value="10"/> | 23. <input type="text" value="13 nautical miles"/> |
| 12. <input type="text" value="10"/> | 24. <input type="text" value="2500 feet"/> |

Step-by-Step Explanations

- | | |
|---|--|
| <p>1. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.</p> <p>2. Legs 6 and 8: $\sqrt{36+64} = \sqrt{100} = 10$.</p> <p>3. Legs 5 and 12: $\sqrt{25+144} = \sqrt{169} = 13$.</p> <p>4. Legs 9 and 12: $\sqrt{81+144} = \sqrt{225} = 15$.</p> <p>5. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.</p> <p>6. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.</p> <p>7. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.</p> <p>8. Legs 12 and 5: $\sqrt{144+25} = \sqrt{169} = 13$.</p> <p>9. Legs 12 and 5: $\sqrt{144+25} = \sqrt{169} = 13$.</p> <p>10. Legs 6 and 8: $\sqrt{36+64} = \sqrt{100} = 10$.</p> <p>11. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.</p> <p>12. Legs 8 and 6: $\sqrt{64+36} = \sqrt{100} = 10$.</p> <p>13. Legs 8 and 15: $\sqrt{64+225} = \sqrt{289} = 17$.</p> <p>14. Legs 7 and 24: $\sqrt{49+576} = \sqrt{625} = 25$.</p> | <p>15. Same x, so the distance is just the vertical change: $12 - 5 = 7$.</p> <p>16. Same y, so the distance is the horizontal change: $6 - (-3) = 9$.</p> <p>17. Legs 2 and 2: $\sqrt{4+4} = \sqrt{8} = 2\sqrt{2}$.</p> <p>18. Legs 3 and 1: $\sqrt{9+1} = \sqrt{10}$.</p> <p>19. Legs 3 and 4: $\sqrt{9+16} = \sqrt{25} = 5$.</p> <p>20. Legs 4 and 3: $\sqrt{16+9} = \sqrt{25} = 5$.</p> <p>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.</p> <p>22. The legs are 9 and 12, so the straight-line distance is $\sqrt{9^2+12^2} = \sqrt{225} = 15$ m.</p> <p>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.</p> <p>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.</p> |
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