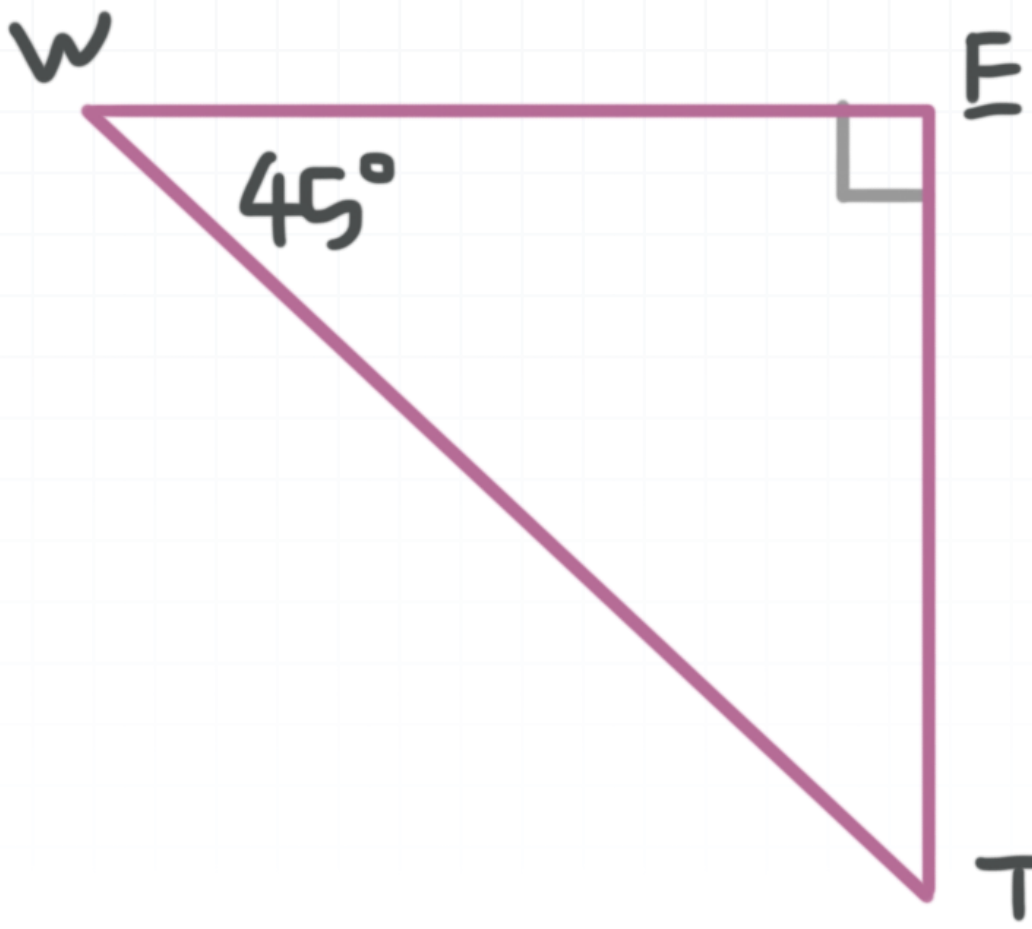
Topic: 45-45-90 triangles

Question: If $\overline{ET} = 3$, what is $\overline{WT}$?



Answer choices:

A $\sqrt{6}$

B $2\sqrt{3}$

C $3\sqrt{2}$

D 9

Solution: C

The triangle $\triangle WET$ is a 45-45-90 triangle, and the pattern for the lengths of the sides of a 45-45-90 triangle is x, x, and $x\sqrt{2}$, where x is the length of each leg.

In this case, $x = 3$, so the lengths of sides $\overline{ET}$, $\overline{WE}$, and $\overline{WT}$ of this 45-45-90 triangle (in which $\overline{WT}$ is the hypotenuse) are 3, 3 and $3\sqrt{2}$, respectively. This means that $\overline{WT} = 3\sqrt{2}$.

Alternatively, we could have used the Pythagorean theorem.

$$a^2 + b^2 = c^2$$

$$3^2 + 3^2 = c^2$$

$$9 + 9 = c^2$$

$$18 = c^2$$

Take the square root of both sides to solve for c.

$$c = \sqrt{18}$$

$$c = \sqrt{9 \cdot 2}$$

$$c = 3\sqrt{2}$$

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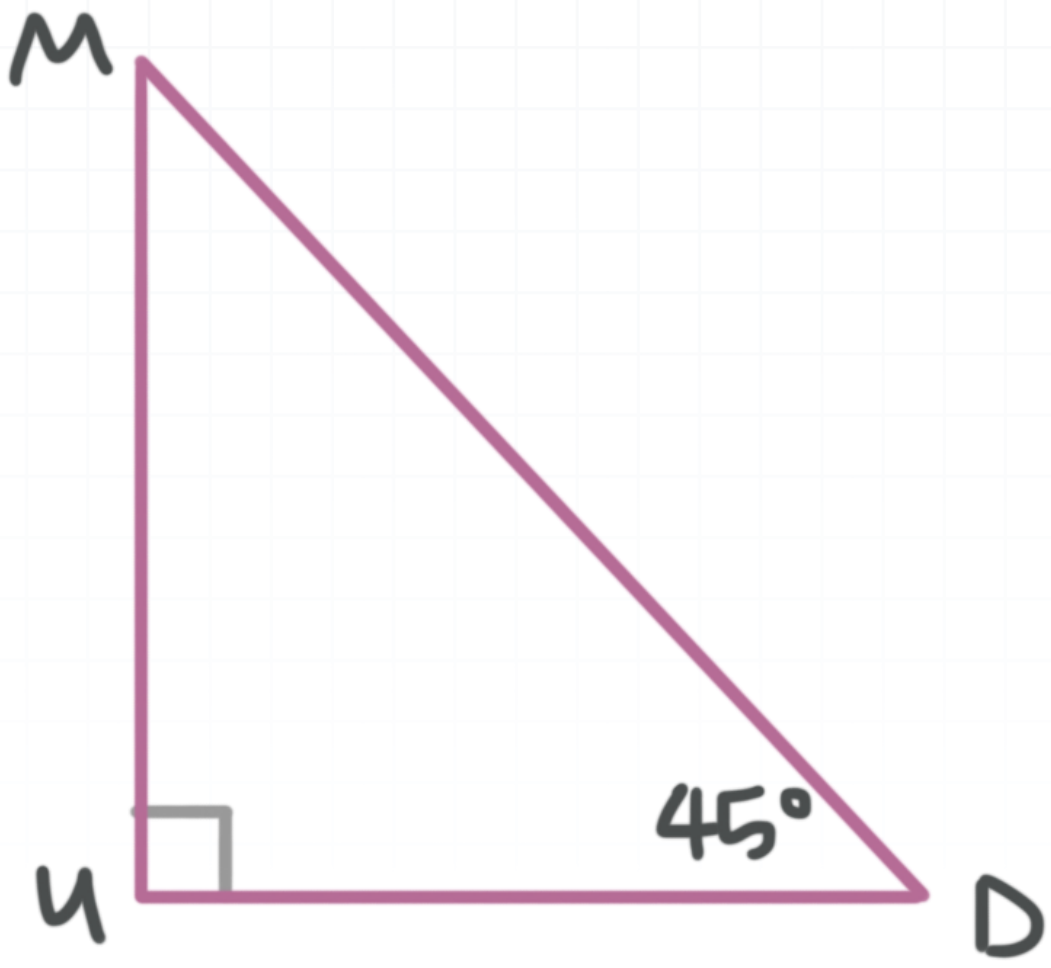
Question: If $\overline{MU} = 2\sqrt{2}$, what is $\overline{MD}$?



Answer choices:

A $\sqrt{2}$

B $4\sqrt{2}$

C 2

D 4

Solution: D

The triangle $\triangle MUD$ is a 45-45-90 triangle, and the pattern for the sides of a 45-45-90 triangle is x, x, and $x\sqrt{2}$, where x is the length of each leg.

In this case, $x = 2\sqrt{2}$, so the lengths of sides $\overline{MU}$, $\overline{UD}$, and $\overline{MD}$ of this 45-45-90 triangle (in which $\overline{MD}$ is the hypotenuse) are $2\sqrt{2}$, $2\sqrt{2}$, and $2\sqrt{2} \cdot \sqrt{2} = 2(2) = 4$, respectively.

Alternatively, we could have used the Pythagorean theorem.

$$a^2 + b^2 = c^2$$

$$(2\sqrt{2})^2 + (2\sqrt{2})^2 = c^2$$

$$4(2) + 4(2) = c^2$$

$$8 + 8 = c^2$$

$$16 = c^2$$

Take the square root of both sides to solve for c.

$$c = \sqrt{16}$$

$$c = 4$$

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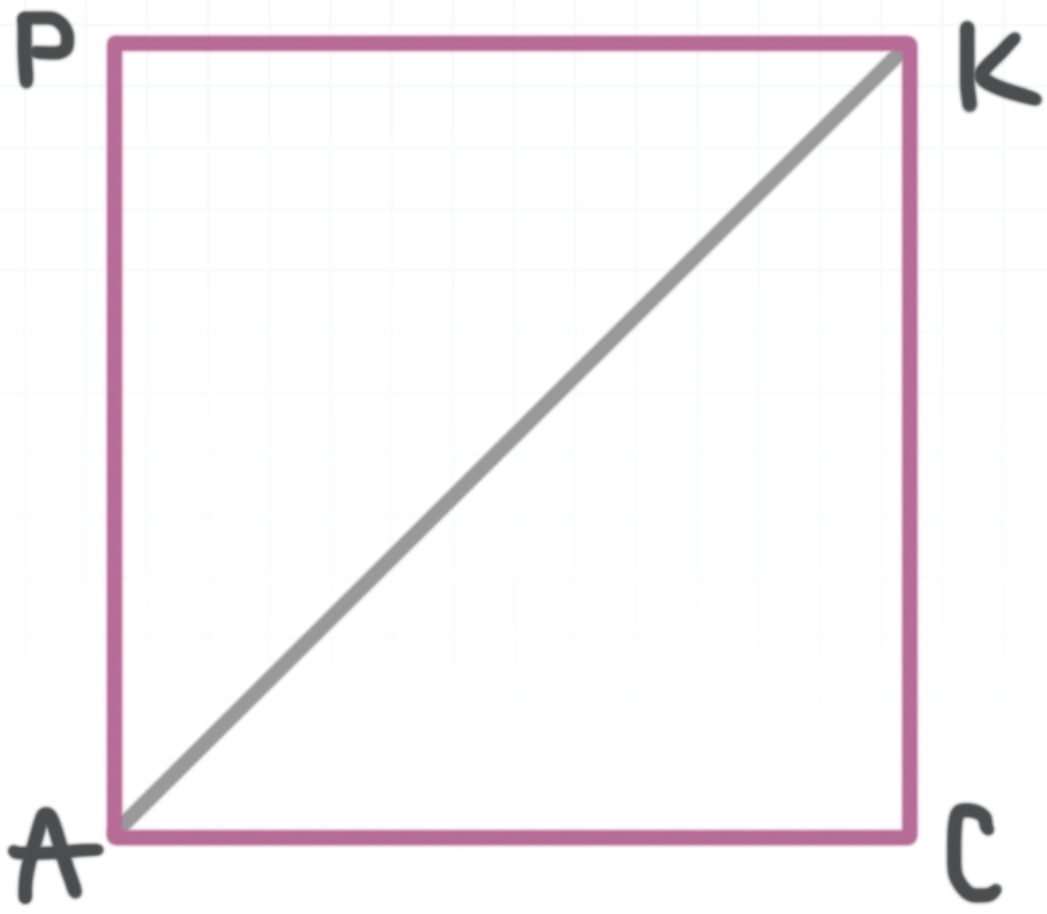
Question: Quadrilateral $PACK$ is a square that has a diagonal of length 4. What is the length of $\overline{PA}$?



Answer choices:

A $2\sqrt{2}$

B $4\sqrt{2}$

C $8\sqrt{2}$

D 4

Solution: A

All four sides of a square are congruent, so $\overline{PA} = \overline{PK}$, which means that $\triangle PAK$ is isosceles. Also, the measure of each of the four interior angles of a square is $90°$, so $\angle APK$ is a right angle. Combining these two results, we see that $\triangle PAK$ is a 45-45-90 triangle.

The pattern for the lengths of the sides of a 45-45-90 triangle is x, x, and $x\sqrt{2}$, where x is the length of each leg. In this case, we see that the hypotenuse of $\triangle PAK$ is side $\overline{AK}$, which is also a diagonal of square $PACK$, so its length is 4 (and is represented by $x\sqrt{2}$).

Write $x\sqrt{2} = 4$ and solve for x.

$$x\sqrt{2} = 4$$

$$x = \frac{4}{\sqrt{2}}$$

$$x = \frac{4}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$$

$$x = \frac{4\sqrt{2}}{2}$$

$$x = 2\sqrt{2}$$

Alternatively, we could have used the Pythagorean theorem.

$$a^2 + b^2 = c^2$$

$$x^2 + x^2 = 4^2$$

$$2x^2 = 16$$

$$x^2 = 8$$

Take the square root of both sides to solve for c.

$$x = \sqrt{8}$$

$$x = \sqrt{4} \cdot \sqrt{2}$$

$$x = 2\sqrt{2}$$