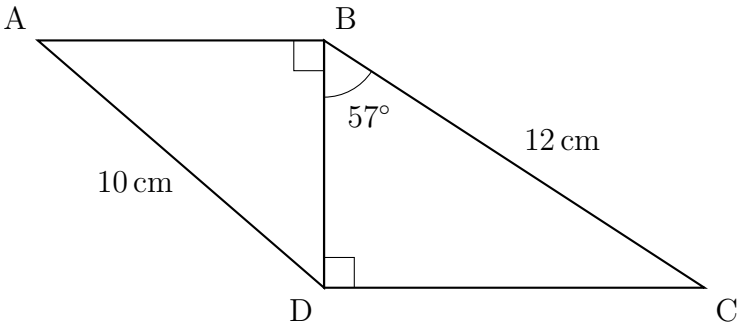
Connected Right-Angled Triangles

Practice Worksheet (Problem Solving)

I Do

The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
$AD = 10\,\text{cm}$, $BC = 12\,\text{cm}$ and angle $DBC = 57°$.



Not to scale

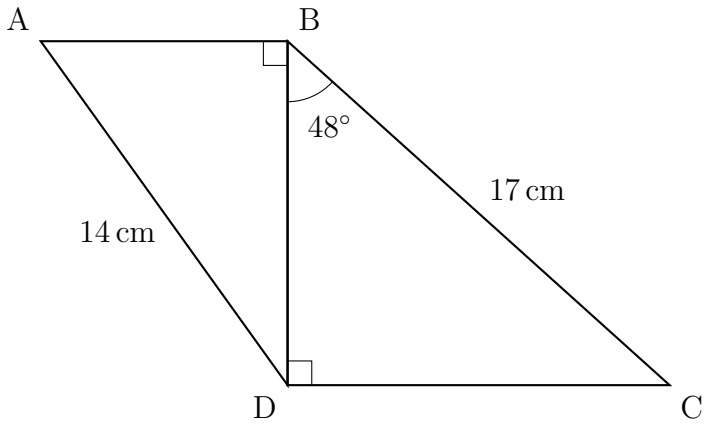
Work out the length of AB.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question is 4 marks)

We Do

The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
$AD = 14\,\text{cm}$, $BC = 17\,\text{cm}$ and angle $DBC = 48°$.



Not to scale

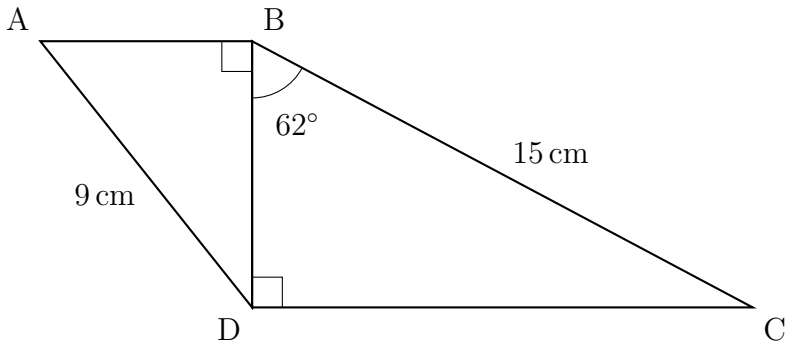
Work out the length of AB.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question is 4 marks)

You Do 1

The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
$AD = 9\,\text{cm}$, $BC = 15\,\text{cm}$ and angle $DBC = 62°$.



Not to scale

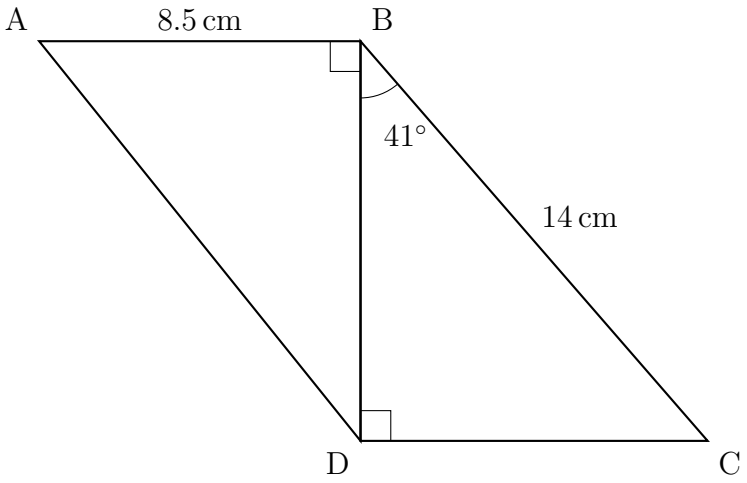
Work out the length of AB.
Give your answer correct to 3 significant figures.

..... cm

(Total for Question is 4 marks)

You Do 2

The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
$AB = 8.5\,\text{cm}$, $BC = 14\,\text{cm}$ and angle $DBC = 41°$.



Not to scale

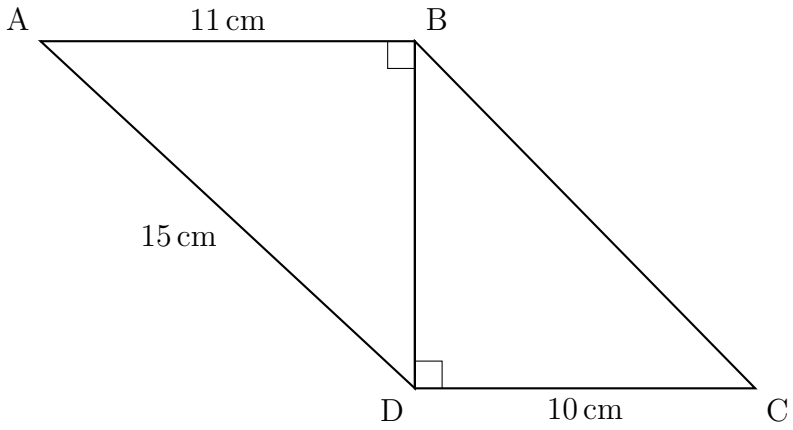
Work out the length of AD.
Give your answer correct to 1 decimal place.

..... cm

(Total for Question is 4 marks)

You Do 3

The diagram shows two right-angled triangles ABD and BCD, sharing a common side BD.
$AD = 15\,\text{cm}$, $AB = 11\,\text{cm}$ and $CD = 10\,\text{cm}$.



Not to scale

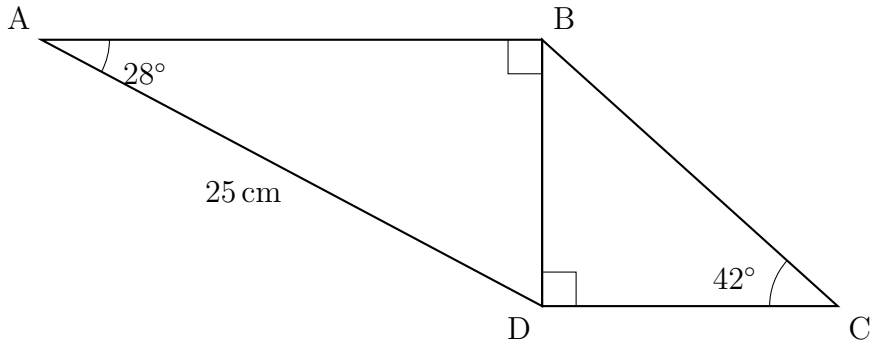
Work out the size of angle DBC.
Give your answer correct to 1 decimal place.

.....°

(Total for Question is 4 marks)

Challenge 1

The diagram shows a quadrilateral ABCD formed by two right-angled triangles.
Angle $ABD = 90°$ and angle $BDC = 90°$.
$AD = 25\,\text{cm}$, angle $DAB = 28°$ and angle $BCD = 42°$.



Not to scale

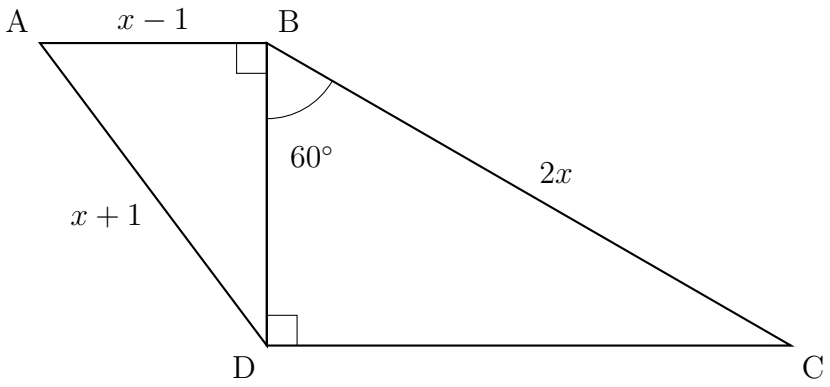
Calculate the perimeter of the quadrilateral ABCD.
Give your answer correct to 1 decimal place.
You must show all your working clearly.

..... cm

(Total for Question is 5 marks)

Challenge 2

The diagram shows two right-angled triangles ABD and BCD.
The lengths of the sides are given in terms of x.
$AD = x + 1$, $AB = x - 1$ and $BC = 2x$.
Angle $DBC = 60°$.



Not to scale

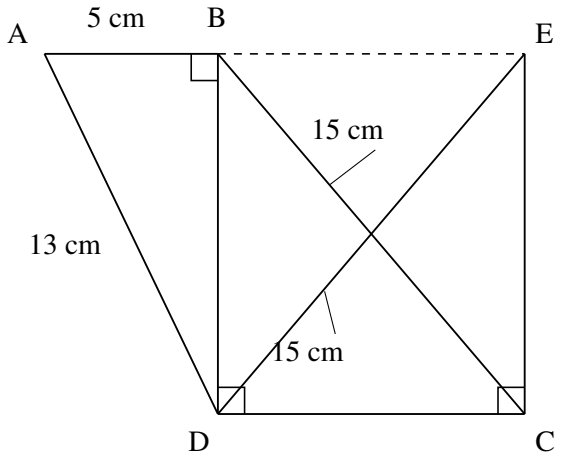
Find the exact value of x.
Show clear algebraic working.

$x =$ .....

(Total for Question is 5 marks)

Extreme Challenge

The diagram shows three connected right-angled triangles: ABD, BCD, and CDE.
Angle $ABD = 90°$, angle $BDC = 90°$, and angle $DCE = 90°$.
$AD = 13\,\text{cm}$, $AB = 5\,\text{cm}$, $BC = 15\,\text{cm}$, and $DE = 15\,\text{cm}$.



Not to scale

Work out the direct distance from point A to point E.
You must show all your mathematical steps clearly.

..... cm

(Total for Question is 6 marks)

Worked Answers

Use degree mode. Keep full calculator precision until the final answer.

I Do

In triangle BCD, $\cos 57^\circ = \frac{BD}{12}$, so $BD = 12 \cos 57^\circ = 6.535668420\ldots$ cm.

In triangle ABD, $AB^2 = AD^2 - BD^2 = 10^2 - (12 \cos 57^\circ)^2 = 57.28503830\ldots$.

Take the positive square root: $AB = 7.568688017\ldots$ cm.

Answer: $AB = 7.57$ cm (3 significant figures).

We Do

$BD = 17 \cos 48^\circ = 11.37522031\ldots$ cm.

$AB^2 = 14^2 - (17 \cos 48^\circ)^2 = 66.60436294\ldots$.

$AB = 8.161149609\ldots$ cm.

Answer: $AB = 8.16$ cm (3 significant figures).

You Do 1

$BD = 15 \cos 62^\circ = 7.042073442\ldots$ cm.

$AB^2 = 9^2 - (15 \cos 62^\circ)^2 = 31.40920164\ldots$.

$AB = 5.604391282\ldots$ cm.

Answer: $AB = 5.60$ cm (3 significant figures).

Worked Answers (continued)

You Do 2

BD = 14 cos 41° = 10.56593412… cm.

$AD^2 = AB^2 + BD^2 = 8.5^2 + (14 \cos 41°)^2 = 183.8889639\ldots$.

AD = 13.56056650… cm.

Answer: AD = 13.6 cm (1 decimal place).

You Do 3

In triangle ABD, $BD^2 = 15^2 - 11^2 = 104$, so BD = $\sqrt{104}$ cm.

In triangle BCD, $\tan(DBC) = \frac{10}{\sqrt{104}}$.

Angle DBC = $\tan^{-1}(10 \div \sqrt{104}) = 44.43824067\ldots°$.

Answer: angle DBC = 44.4° (1 decimal place).

Challenge 1

In triangle ABD, BD = 25 sin 28° = 11.73678907… cm and AB = 25 cos 28° = 22.07368982… cm.

In triangle BCD, $BC = \frac{25 \sin 28°}{\sin 42°} = 17.54035604\ldots$ cm.

$CD = \frac{25 \sin 28°}{\tan 42°} = 13.03502482\ldots$ cm.

Perimeter = AB + BC + CD + AD = 77.64907068… cm.

Answer: perimeter = 77.6 cm (1 decimal place).

Worked Answers (continued)

Challenge 2

In triangle BCD, $BD = 2x \cos 60^\circ = x$, so $BD^2 = x^2$.

In triangle ABD, $BD^2 = (x + 1)^2 - (x - 1)^2 = 4x$.

Equate the expressions: $x^2 = 4x$, so $x(x - 4) = 0$.

$AB = x - 1$ must be positive, so $x > 1$. Reject $x = 0$.

Answer: $x = 4$. Check: $AB = 3$, $BD = 4$, $AD = 5$ and $BC = 8$.

Extreme Challenge

In triangle ABD, $BD = \sqrt{(13^2 - 5^2)} = \sqrt{144} = 12$ cm.

In triangle BCD, $CD = \sqrt{(15^2 - 12^2)} = \sqrt{81} = 9$ cm.

In triangle CDE, $CE = \sqrt{(15^2 - 9^2)} = \sqrt{144} = 12$ cm.

BD and CE are both perpendicular to CD and both 12 cm long. B and E are on the same side of CD, so BDCE is a rectangle.

Therefore B and E are level and $BE = CD = 9$ cm. A, B and E lie on the same straight line, with B between A and E.

Answer: $AE = AB + BE = 5 + 9 = 14$ cm.