Area of a Trapezium

Practice Worksheet (Foundation · Target Grade 5)

I Do

A trapezium has parallel sides of length 7 cm and 11 cm.
The area of the trapezium is $72\,\text{cm}^2$.

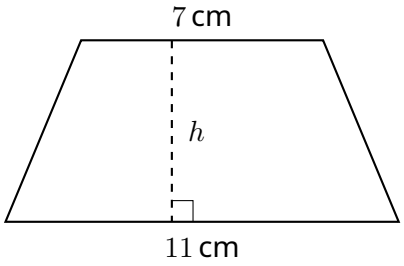


Diagram **NOT** accurately drawn

Work out the perpendicular height of the trapezium.

.....cm

(Total for Question is 3 marks)

We Do

A trapezium has parallel sides of length 8 cm and 12 cm.
The area of the trapezium is $90\,\text{cm}^2$.

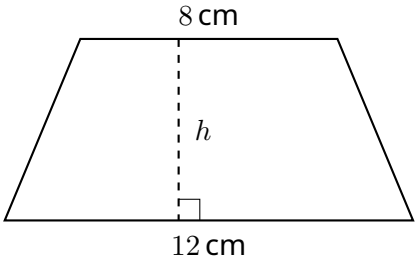


Diagram **NOT** accurately drawn

Work out the perpendicular height of the trapezium.

.....cm

(Total for Question is 3 marks)

You Do 1

A trapezium has parallel sides of length 6 cm and 14 cm.
The area of the trapezium is 85 cm^2.

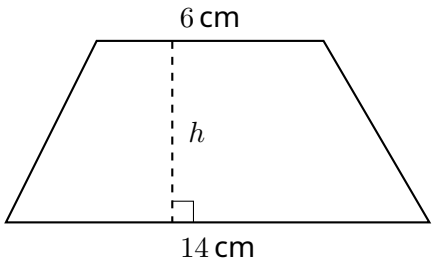


Diagram **NOT** accurately drawn

Work out the perpendicular height of the trapezium.

.....cm

(Total for Question is 3 marks)

You Do 2

A trapezium has parallel sides of length a cm and 15 cm, and a perpendicular height of 6 cm.
The area of the trapezium is 69 cm^2.

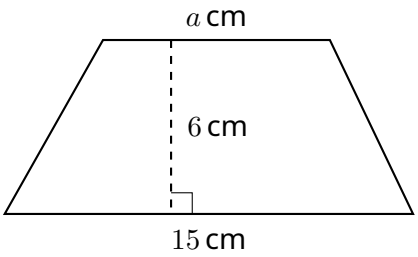


Diagram **NOT** accurately drawn

Work out the value of a.

$a =$ .....

(Total for Question is 3 marks)

You Do 3

A right-angled trapezium has vertical parallel sides of length 9 cm and 13 cm, and a horizontal base of length w cm.
The area of the trapezium is 77 cm^2.

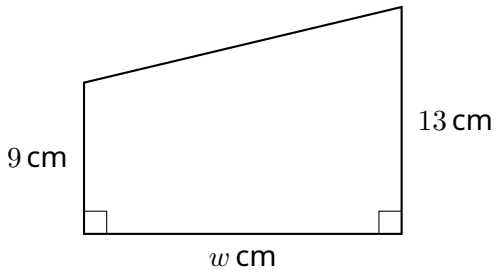


Diagram **NOT** accurately drawn

Work out the value of w.

$w =$ .....

(Total for Question is 3 marks)

Challenge 1

A trapezium has parallel sides of length $(x + 3)$ cm and $(2x + 5)$ cm, and a perpendicular height of 6 cm.
The area of the trapezium is 78 cm^2.

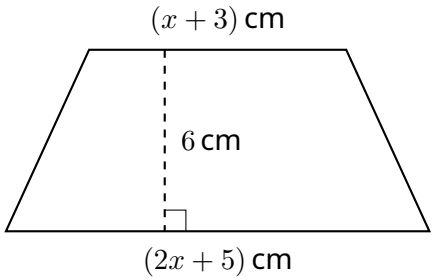


Diagram **NOT** accurately drawn

Work out the value of x, and hence find the lengths of the two parallel sides.
Show all of your algebraic working clearly.

$x =$ ..... Parallel sides: .....cm and .....cm

(Total for Question is 4 marks)

Challenge 2

The diagram shows an isosceles trapezium with parallel sides of length 10 cm and 22 cm.
Each of the two slanted sides has length 10 cm.

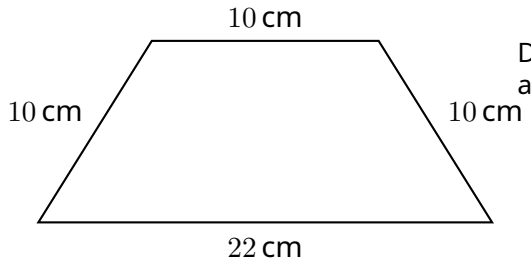


Diagram **NOT** accurately drawn

Calculate the area of the trapezium.
You must show all of your working clearly.

.....cm^2

(Total for Question is 4 marks)

Extreme Challenge

A trapezium has parallel sides of length $(x + 2)$ cm and $(3x - 2)$ cm, and a perpendicular height of $(x + 1)$ cm.
The area of the trapezium is 84 cm^2.

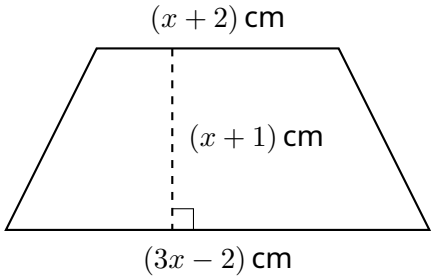


Diagram **NOT** accurately drawn

(a) Show that $x^2 + x - 42 = 0$.

(3 marks)

(b) Hence, find the perpendicular height of the trapezium.
Show all of your algebraic working clearly.

.....cm *(2 marks)*

(Total for Question is 5 marks)

Worked Answers

I Do

Use the area of a trapezium formula: Area $= \frac{1}{2}(a+b)h$.

$72 = \frac{1}{2}(7+11) \times h$

$72 = \frac{1}{2}(18) \times h \implies 72 = 9h \implies$ **h = 8 cm**.

We Do

$90 = \frac{1}{2}(8+12) \times h$

$90 = 10h \implies$ **h = 9 cm**.

You Do 1

$85 = \frac{1}{2}(6+14) \times h$

$85 = 10h \implies$ **h = 8.5 cm**.

You Do 2

$69 = \frac{1}{2}(a+15) \times 6$

$69 = 3(a+15)$

Divide both sides by 3: $23 = a + 15 \implies$ **a = 8**.

You Do 3

The perpendicular distance between the vertical parallel sides is w:

$77 = \frac{1}{2}(9+13) \times w$

$77 = 11w \implies$ **w = 7**.

Challenge 1

1. Substitute the algebraic expressions into Area $= \frac{1}{2}(a+b)h$:

$78 = \frac{1}{2}\big((x+3)+(2x+5)\big) \times 6$

$78 = 3(3x+8)$

2. Divide both sides by 3:

$26 = 3x + 8 \implies 3x = 18 \implies$ **x = 6**.

3. Substitute $x = 6$ to find the parallel sides:

$x + 3 = 6 + 3 =$ **9 cm**, $\quad 2x + 5 = 2(6) + 5 =$ **17 cm**.

Challenge 2

1. Drop two perpendicular heights from the top corners to the bottom edge.
Because the trapezium is isosceles, the two outer base sections are equal:
Base of each right-angled triangle $= \dfrac{22-10}{2} = \dfrac{12}{2} = 6$ cm.

2. Use Pythagoras' theorem to find the perpendicular height h:
$h^2 + 6^2 = 10^2$
$h^2 = 100 - 36 = 64 \implies h = \sqrt{64} = 8$ cm.

3. Calculate the area of the trapezium:
Area $= \dfrac{1}{2}(10 + 22) \times 8 = 16 \times 8 =$ **128 cm²**.

Extreme Challenge

(a) Substitute into the area formula:
$\dfrac{1}{2}\big((x+2) + (3x-2)\big)(x+1) = 84$
Simplify the sum of the parallel sides: $(x+2) + (3x-2) = 4x$.
$\dfrac{1}{2}(4x)(x+1) = 84$
$2x(x+1) = 84$
Divide both sides by 2:
$x(x+1) = 42$
$x^2 + x = 42 \implies x^2 + x - 42 = 0$. *(Shown)*

(b) Factorise the quadratic equation:
$(x+7)(x-6) = 0 \implies x = -7$ or $x = 6$.
Since lengths must be positive, $x = 6$.
Therefore, the perpendicular height is $x + 1 = 6 + 1 =$ **7 cm**.