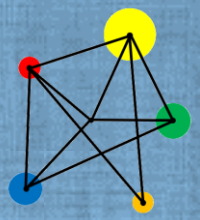
Create & Solve Linear Equations



Create equations to represent real life situations.

Solve linear equations and make sense of the solutions

Vocabulary

Equation
A mathematical statement of the form $2x + 3 = 7$. The statement must contain an equals sign and usually contains one unknown letter (often x).

Linear
An equation of the form $ax + b = c$.

Solution
The value that makes an equation true. It is frequently the job of a mathematician to find the solution of an equation.

Solve
The process of finding the solution of an equation.

Key facts

An equation is a mathematical statement such as $4x - 1 = 11$.

We can form and solve linear equations to help us answer real life problems.

Review of linear equations

Solve the equations:

1. $x + 9 = 21$
2. $2x = 72$
3. $3x - 1 = 23$
4. $20 - 3x = 8$
5. $4x = 15$
6. $\frac{x}{2} = 19$

Solve the equations:

1. $5(x + 2) = 45$
2. $8(x - 4) = 48$
3. $4x - 7 = 2x + 9$
4. $3x + 9 = 5x + 1$
5. $\frac{x}{5} - 7 = 7$

Solve the equations:

1. $\frac{x}{3} + 1 = 8$
2. $\frac{x - 2}{4} = 3$
3. $\frac{x - 3}{4} = \frac{15 - x}{2}$

Solutions

Solve the equations:

1. $x + 9 = 21$ **x = 12**
2. $2x = 72$ **x = 36**
3. $3x - 1 = 23$ **x = 8**
4. $20 - 3x = 8$ **x = 4**
5. $4x = 15$ **x = $\frac{15}{4}$**
6. $\frac{x}{2} = 19$ **x = 38**

Solve the equations:

1. $5(x + 2) = 45$ **x = 7**
2. $8(x - 4) = 48$ **x = 10**
3. $4x - 7 = 2x + 9$ **x = 8**
4. $3x + 9 = 5x + 1$ **x = 4**
5. $\frac{x}{5} - 7 = 7$ **x = 70**

Solve the equations:

1. $\frac{x}{3} + 1 = 8$ **x = 21**
2. $\frac{x - 2}{4} = 3$ **x = 14**
3. $\frac{x - 3}{4} = \frac{15 - x}{2}$ **x = 11**

Example 1

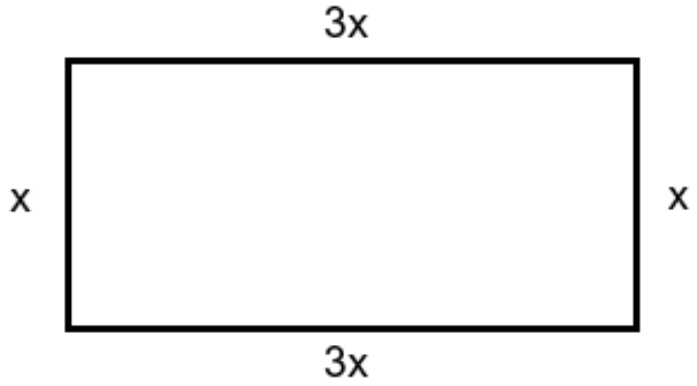
A rectangle is three times as long as it is wide.

The rectangle has a perimeter of 48cm.

Find the area of the rectangle.

A rectangle is three times as long as it is wide.
The rectangle has a perimeter of 48cm.
Find the area of the rectangle.

Step 1 : Label the sides.



Step 2 : Convert the statement into an equation.

$$x + 3x + x + 3x = 48$$

Step 3 : Solve the equation.

$$x + 3x + x + 3x = 48$$

$$8x = 48$$

$$x = 6\text{cm}$$

Step 4 : Answer the question.

The lengths of the sides are 6cm and 18cm.

$$\text{Area} = 6 \times 18$$

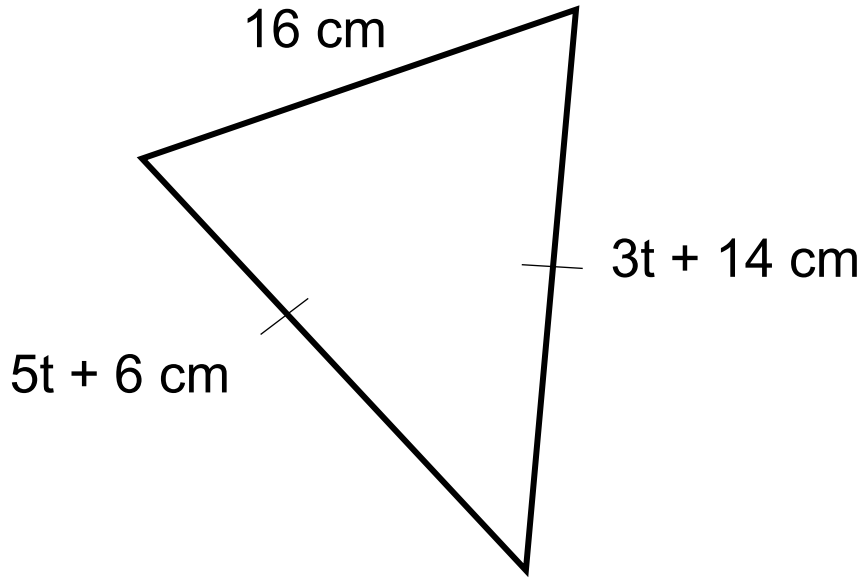
$$= 108\ \text{cm}^2$$

You try...

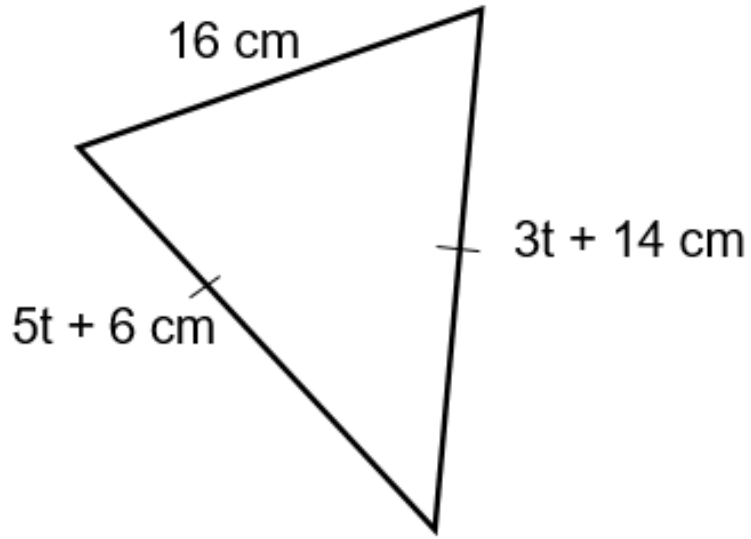
Here is an isosceles triangle.

Form and solve an equation to find the value of t.

Hence find the perimeter of the triangle.



Here is an isosceles triangle.
Form and solve an equation to find the value of t.
Hence find the perimeter of the triangle.



Write an equation.

$$5t + 6 = 3t + 14$$

Solve the equation.

$$2t + 6 = 14$$

$$2t = 8$$

$$t = 4$$

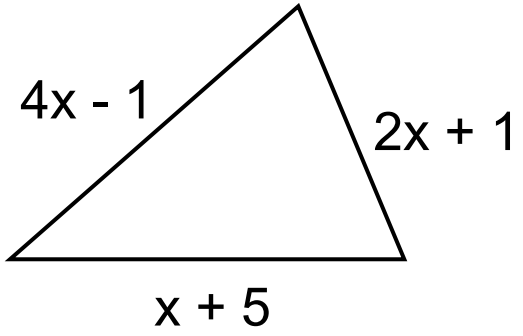
Answer the question.

$$\text{Perimeter} = 26 + 26 + 16$$

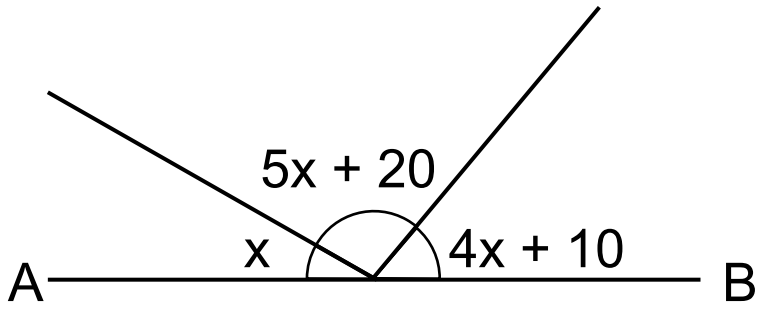
$$= \underline{68 \text{ cm}}$$

Exercise

The perimeter of this triangle is 40cm



Find the length of the shortest side.



AB is a straight line.

Find the size of the largest angle.

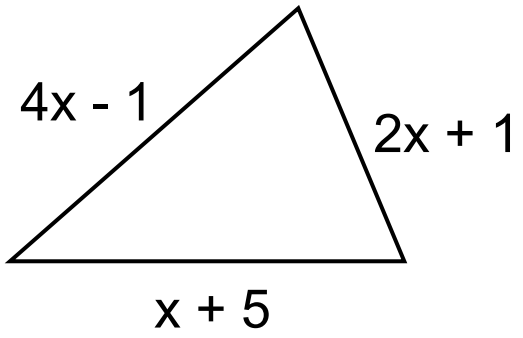
The sum of three numbers is 66.

The second number is four times the first and the third number is six less than the second.

What are the numbers?

Solutions

The perimeter of this triangle is 40cm



Find the length of the shortest side.

$4x - 1 + 2x + 1 + x + 5 = 40$

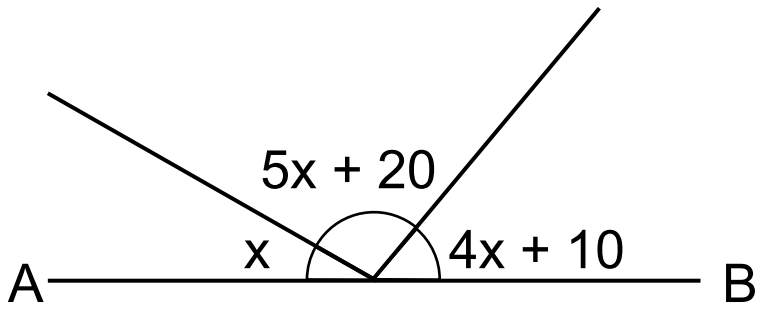
$7x + 5 = 40$

$7x = 35$

$x = 5$

The shortest side is $x + 5$

$= 10\text{cm}$



AB is a straight line.

Find the size of the largest angle.

$x + 5x + 20 + 4x + 10 = 180$

$10x + 30 = 180$

$10x = 150$

$x = 15$

The largest angle is $5x + 20$

$= 95^{o}$

The sum of three numbers is 66.

The second number is four times the first and the third number is six less than the second.

What are the numbers?

$x + 4x + 4x - 6 = 66$

$9x - 6 = 66$

$9x = 72$

$x = 8$

The numbers are 8 , 32 and 26

Form an equation to solve each problem.

The sum of two consecutive numbers is 31.

What are the numbers?

The three angles of a triangle are in the ratio 3 : 7 : 8.

How big are the angles?

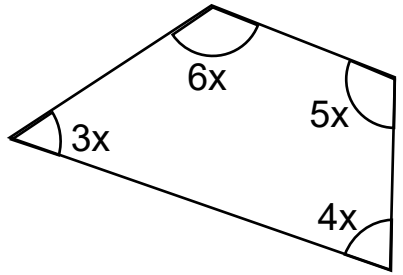
The width of a rectangle is half the length of the rectangle.

The perimeter of the rectangle is 42cm.

Find the lengths of the sides.

Three consecutive integers have a sum of 198.

What is the first integer?



What is the size of the largest angle in this quadrilateral?

Two numbers are in the ratio 5:1 and their sum is 21.

Find the numbers.

If I subtract five times a certain number from 14, then I get twice the number.

What is the number?

The sum of five consecutive integers is 2025.

What is the first of these integers?

A teacher has enough pencils to give all her pupils 3 pencils and have 28 left over.

Alternatively, she could give every pupil 4 pencils and have 4 left over.

How many pencils does she have?

Challenge

The angles of a quadrilateral taken in order are 4x°, 5x°, 4x° and 5x°.

What type of quadrilateral is it?

Form an equation to solve each problem.

The sum of two consecutive numbers is 31.

What are the numbers? **15 , 16**

The three angles of a triangle are in the ratio 3 : 7 : 8.

30° , 70° , 80°

How big are the angles?

The width of a rectangle is half the length of the rectangle.

The perimeter of the rectangle is 42cm.

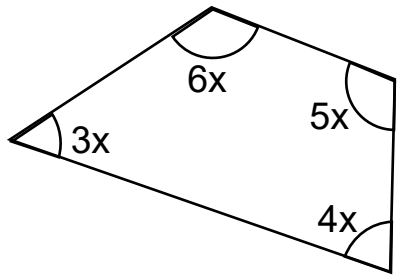
7cm and 14cm

Find the lengths of the sides.

Three consecutive integers have a sum of 198.

What is the first integer? **63**

120°



What is the size of the largest angle in this quadrilateral?

Two numbers are in the ratio 5:1 and their sum is 21.

Find the numbers. **$3\frac{1}{2}$ and $17\frac{1}{2}$**

If I subtract five times a certain number from 14, then I get twice the number.

What is the number? **2**

The sum of five consecutive integers is 2025.

What is the first of these integers?

403

A teacher has enough pencils to give all her pupils 3 pencils and have 28 left over.

Alternatively, she could give every pupil 4 pencils and have 4 left over.

100

How many pencils does she have?

Challenge

The angles of a quadrilateral taken in order are 4x°, 5x°, 4x° and 5x°.

What type of quadrilateral is it?

Parallelogram

Extension

The sides of a rectangle are in the ratio 2 : 3.

The area of the rectangle is 150 cm^2.

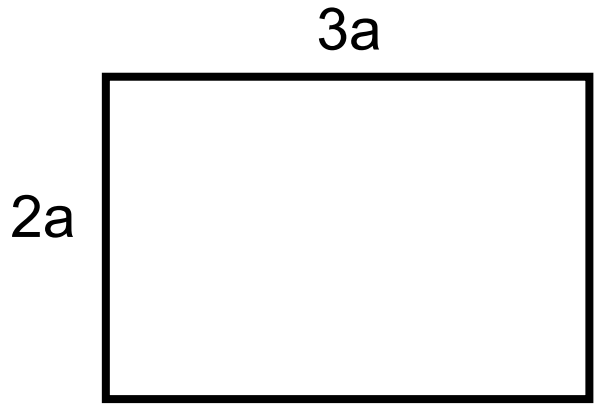
Find the perimeter of the rectangle.

Solution

The sides of a rectangle are in the ratio 2 : 3.

The area of the rectangle is 150 cm^2.

Find the perimeter of the rectangle.



$2a \times 3a = 150$

$6a^2 = 150$

$a^2 = 25$

$a = 5cm$

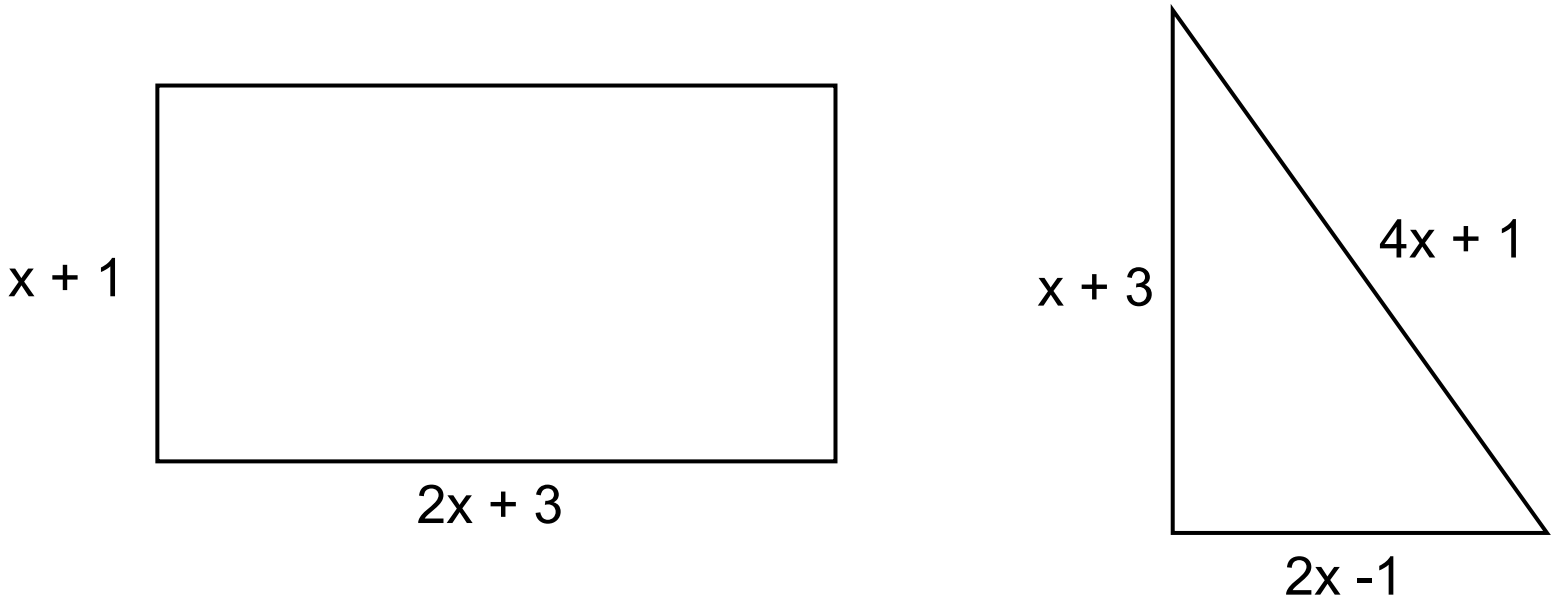
Perimeter = 10 + 15 + 10 + 15

= 50 cm

Exam Style Question

The diagram shows a rectangle and a triangle.

All lengths are in centimetres.



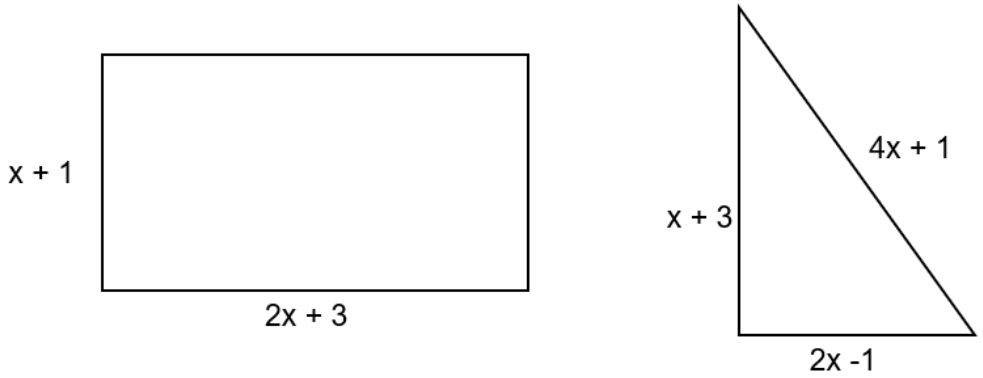
The perimeter of the rectangle is equal to the perimeter of the triangle.

Find the area of the triangle

Solution

The diagram shows a rectangle and a triangle.

All lengths are in centimetres.



The perimeter of the rectangle is equal to the perimeter of the triangle.

Find the area of the triangle

$$6x + 8 = 7x + 3$$

$$8 = x + 3$$

$$x = 5$$

$$\text{Area of triangle} = \frac{\text{base x height}}{2}$$

$$= \frac{9 \times 8}{2}$$

$$= 36cm^2$$