

OXFORD IB DIPLOMA PROGRAMME



PRIOR LEARNING SUPPORT

MATHEMATICS: APPLICATIONS AND INTERPRETATION

HIGHER LEVEL
COURSE COMPANION

 ENHANCED ONLINE

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OXFORD

Rounding and estimation

To round to a given number of **decimal places**:

- Look at the figure in the next decimal place.
- If this figure is less than 5, round.

To round to a given number of **significant figures**:

- For any number, read from left to right and ignore the decimal point.
- The first significant figure is the first non-zero digit, the second significant figure is the next digit (which can be zero or otherwise), and so on.

3 5 . 2 7 1
1st sf 2nd sf 3rd sf 4th sf 5th sf

0 . 5 3 9
 1st sf 2nd sf 3rd sf

Example 1

Write the number 8.0426579 to

- a** 2 decimal places **b** 1 significant figure **c** 1 decimal place
d 4 decimal places **e** 6 significant figures

Answer

- a** 8.04 *8.042 next digit less than 5 so round down*
b 8 *8.0 next digit less than 5 so round down*
c 8.0 *8.04 next digit less than 5 so round down*
d 8.0427 *8.04265 next digit 5 so round up*
e 8.04266 *8.042657 next digit less than 5 so round up*

Example 2

Round 42536 to 3 significant figures.

Answer

42500 *42536 next digit (3) less than 5 so round down*
replace any other digit before the decimal place with zeros

To **estimate** the value of a calculation, write all the numbers to one significant figure.

For example, to estimate the value of $197.2 \div 3.97$, calculate $200 \div 4 = 50$

Estimating the answer to a calculation first gives you an idea of the answer to expect. If your GDC gives you a very different answer, you can then check if you keyed in the values correctly.

Exercise

Solve these quadratic equations by completing the square.

1 Write each number to the nearest number given in the bracket.

a 2177 (ten) **b** 439 (hundred) **c** 3532 (thousands)

d 20.73 (unit) **e** 12.58 (unit)

2 Write each number to the number of decimal places given in the bracket.

a 0.6942 (2) **b** 28.75 (1) **c** 0.9999 (2)

d 77.984561 (3) **e** 0.05876 (2)

3 Write each number in question 1 correct to 2 significant figures.

4 Write each number in question 2 correct to 3 significant figures.

5 Write each fraction as a decimal to 3 significant figures.

a $\frac{2}{3}$ **b** $\frac{3}{46}$ **c** $\frac{5}{13}$

6 Write down an estimate for the value of the following calculations.

a $54.04 \div 9.89$ **b** $\frac{2.8 \times 3.79}{1.84}$ **c** $\frac{7.08 - 0.7556}{(8.67)^2}$

7 Use your GDC to estimate each part of question 6 to 3 significant figures.

Answers

- | | | | | |
|-----------------------------|-------------------------------------|-----------------------------------|-----------------|-----------------|
| 1 a 2180 | b 400 | c 4000 | d 21 | e 13 |
| 2 a 0.69 | b 28.8 | c 1.00 | d 77.985 | e 0.06 |
| 3 a 2200 | b 440 | c 3500 | d 21 | e 13 |
| 4 a 0.694 | b 28.8 | c 1.00 | d 78.0 | e 0.0588 |
| 5 a 0.667 | b 0.0652 | c 0.385 | | |
| 6 a $50 \div 10 = 5$ | b $\frac{3 \times 4}{2} = 6$ | c $\frac{7-1}{9^2} = 0.07$ | | |
| 7 a 5.46 | b 5.77 | c 0.0841 | | |

Exponential expressions

Repeated multiplication can be written as an exponential expression.

For example, squaring a number $3 \times 3 = 3^2$ or $5.42 \times 5.42 = 5.42^2$.

If we multiply a number by itself three times then the exponential expression is a cube. For example

$$4.6 \times 4.6 \times 4.6 = 4.6^3.$$

You can also use exponential expressions for larger integer values.

So, for example, $3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$.

Where the exponent is not a positive integer, these rules apply:

$$a^0 = 1, a \neq 0 \text{ and } a^{-n} = \frac{1}{a^n}$$

Example

Write down the values of 10^2 , 10^3 , 10^1 , 10^0 , 10^{-2} , 10^{-3} .

Answer

$$10^2 = 10 \times 10 = 100$$

$$10^3 = 10 \times 10 \times 10 = 1000$$

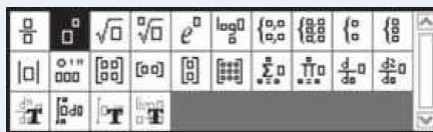
$$10^1 = 10$$

$$10^{-2} = \frac{1}{10^2} = \frac{1}{100} = 0.01$$

$$10^{-3} = \frac{1}{10^3} = \frac{1}{1000} = 0.001$$

To evaluate an exponential function with the GDC use

either the \wedge key or the template key $\left| \begin{smallmatrix} \square & | & \square \\ \square & | & \square \end{smallmatrix} \right|$ and the exponent template.



Exercise

Evaluate these expressions.

1 a $2^3 + 3^2$

b $4^2 \times 3^2$

c 2^6

2 a 5^0

b 3^{-2}

c 2^{-4}

3 a 3.5^5

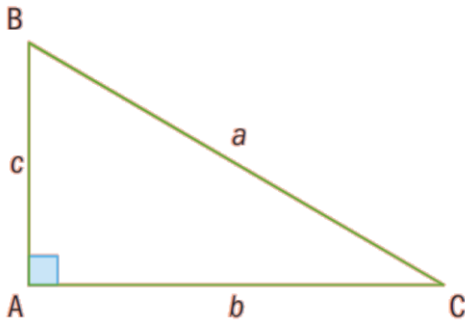
b 0.495^{-2}

c $2 \frac{(1 - 0.02)^{10}}{1 - 0.02}$

Answers**1 a** 17**b** 144**c** 64**2 a** 0**b** $\frac{1}{9}$ **c** $\frac{1}{16}$ **3 a** 525.219**b** 4.081**c** 2.488

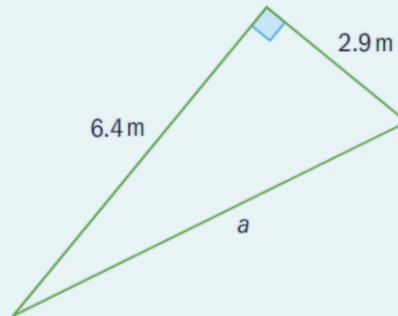
Pythagoras' theorem

In a right-angled triangle ABC with sides a , b and c , where a is the hypotenuse: $a^2 = b^2 + c^2$



Example 1

Find the length marked a .



Answer

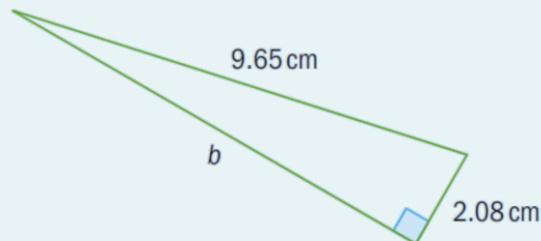
$$a^2 = 6.4^2 + 2.9^2$$

$$a = \sqrt{6.4^2 + 2.9^2} = 7.03 \text{ cm}$$

You can use Pythagoras' Theorem to calculate the length of one side of a right-angled triangle when you know the other two.

Example 2

Find the length marked b .



Answer

$$9.65^2 = b^2 + 2.08^2$$

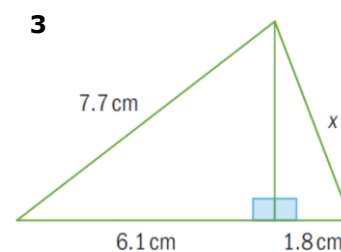
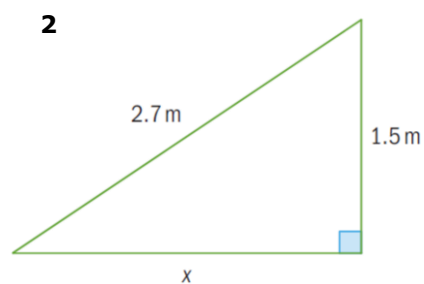
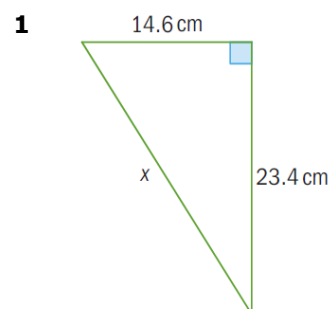
$$b^2 = 9.65^2 - 2.08^2$$

$$a = \sqrt{9.65^2 - 2.08^2} = 9.42 \text{ cm}$$

Check your answer by making sure that the hypotenuse is the longest side of the triangle.

Exercise

In each diagram, find the length of the side marked x . Give your answer to 3 significant figures.



Answers

1 27.6 cm

2 2.24 cm

3 5.03 cm

Measures of central tendency

A measure of central tendency, or average, describes a typical value for a set of data.

There are three common types of average:

- The mode - this is the data value that occurs most often.
- The median - this is the middle item when the data is arranged in order of size.
- The mean - this is what most people mean when they use the word "average". It is found by adding up all of the data and dividing by the number of pieces of data.

Example 1

Find **a** the mode **b** the median and **c** the mean of this data set:

2, 5, 4, 9, 1, 3, 2, 6, 9, 2, 5, 1, 3, 4

Answers

a The mode is 2

2 occurs the most often

b 1, 2, 2, 2, 3, 4, 4, 5, 5, 6, 9, 9, 1, 3

Write them in order and find the middle one

The median is 4

c Mean = $\frac{1 + 2 + 2 + 2 + 3 + 4 + 4 + 5 + 5 + 6 + 9 + 9 + 13}{13}$

Add them all together. There

$$= \frac{65}{13} = 5$$

are 13 pieces of data, so divide by 13.

Exercise

1 Find **a** the mode **b** the median and **c** the mean of

a 1, 4, 1, 5, 6, 7, 3, 1, 8

b 4, 7, 5, 12, 5, -3, -2

c 2, 3, 8, 2, 1, 7, 9, 8, 5

d 25, 28, 29, 21, 25, 20, 27

e 7.4, 10.2, 12.5, 6.8, 10.2

2 Fifteen students were asked how many brothers and sisters they had. The results were:

2, 2, 1, 0, 3, 5, 2, 1, 1, 0, 1, 4, 1, 0, 2.

Find **a** the mode, **b** the median and **c** the mean number of brothers and sisters.

3 My last nine homework scores, marked out of 10, were:

8, 7, 9, 10, 8, 9, 6, 8, 7

Find **a** the mode **b** the median and **c** the mean homework score.

- 4** A sprinter's times in seconds for the 40 m dash were:

5.1 3, 4.82, 5.25, 4.94, 5.06, 4.82, 5.12

Find **a** the mode, **b** the median and **c** the mean of the times.

- 5** Seven farmers own different numbers of chickens.

These numbers are:

253, 78, 497, 166, 710, 497 and 599

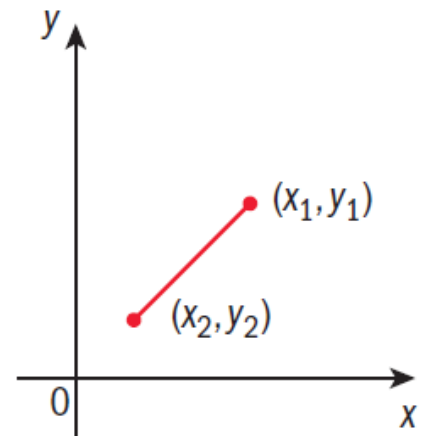
Find **a** the mode, **b** the median and **c** the mean number of chickens.

Answers

- 1 a** mode=1, median=4, mean=4 **b** mode=5, median=5, mean=4
c mode=2 and 8, median=5, mean=5 **d** mode=25, median=25, mean=25
e mode=10.2, median=10.2, mean=9.42
- 2 a** 1 **b** 1 **c** 1.67
3 a 8 **b** 8 **c** 9
4 a 4.82 **b** 5.06 **c** 5.02
5 a 497 **b** 497 **c** 400

Distance between two points

The distance between two points with coordinates (x_1, y_1) and (x_2, y_2) is given by $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.



Example

Find the distance between the points with coordinates $(2, -3)$ and $(-5, 4)$.

Answer

$$\text{Distance} = \sqrt{(-5 - 2)^2 + (4 - (-3))^2} = \sqrt{(-7)^2 + 7^2} = 9.90 \quad (3 \text{ s.f.})$$

Exercise

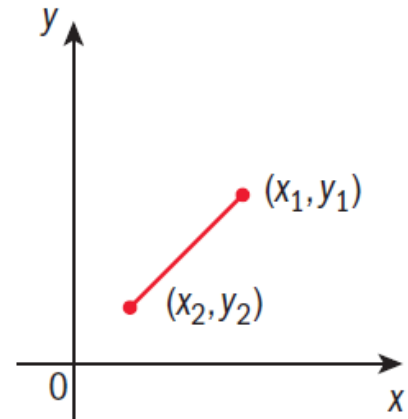
Calculate the distance between the following pairs of points. Give your answer to 3 significant figures where appropriate.

- 1 $(1, 2)$ and $(4, 6)$
- 2 $(-2, 5)$ and $(3, -3)$
- 3 $(-6, -6)$ and $(1, 7)$

Answers**1** 5**2** 9.43**3** 14.8

Midpoints

The midpoint of a line segment joining the points with coordinates (x_1, y_1) and (x_2, y_2) is given by $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$



Example

Find the midpoint of the line segment joining the points with coordinates $(1, 7)$ and $(-3, 3)$.

Answer

The midpoint is $= \left(\frac{1 + (-3)}{2}, \frac{7 + 3}{2}\right) = (-1, 5)$

Exercise

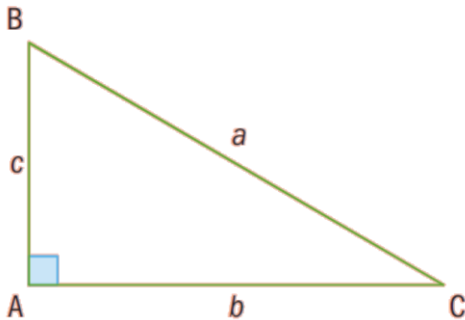
Calculate the midpoints of the lines joining the following pairs of points.

- 1 $(2, 7)$ and $(8, 3)$
- 2 $(-6, 5)$ and $(4, -7)$
- 3 $(-2, -1)$ and $(5, 6)$

Answers**1** $(5, 5)$ **2** $(-1, -1)$ **3** $(1.5, 2.5)$

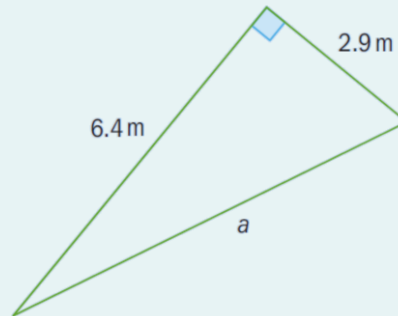
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Example 1

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Answer

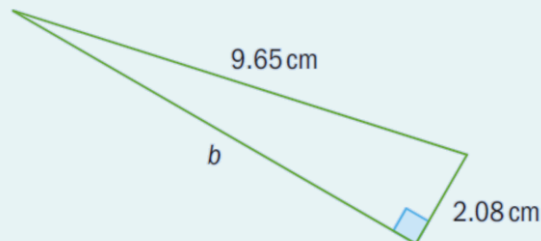
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You can use Pythagoras' Theorem to calculate the length of one side of a right-angled triangle when you know the other two.

Example 2

Find the length marked b .



Answer

$$9.65^2 = b^2 + 2.08^2$$

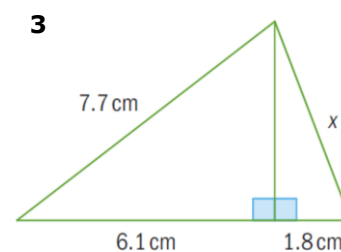
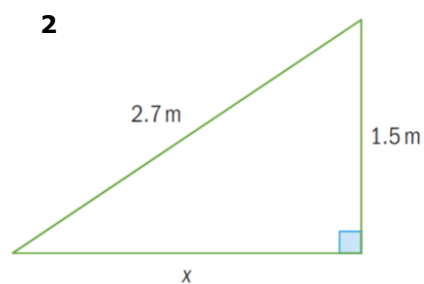
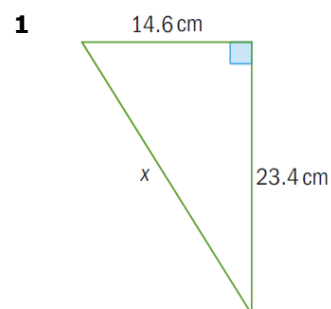
$$b^2 = 9.65^2 - 2.08^2$$

$$b = \sqrt{9.65^2 - 2.08^2} = 9.42 \text{ cm}$$

Check your answer by making sure that the hypotenuse is the longest side of the triangle.

Exercise

In each diagram, find the length of the side marked x . Give your answer to 3 significant figures.



Answers

1 27.6 cm

2 2.24 cm

3 5.03 cm

Substituting into formulae

Substitution means putting numbers in place of letters. It is important to follow the order of operations.

When using formulae, you can use your GDC to do the calculation for you. You should still show your working.

- 1 Find the formula you are going to use (from the formula booklet, from the question or from memory) and write it down.
- 2 Identify the values that you are going to substitute into the formula.
- 3 Write out the formula with the values substituted for the letters.
- 4 Enter the formula into your calculator. Use templates to make the formula look the same on your GDC as it is on paper.
- 5 If you think it is necessary, use brackets. It is better to have too many brackets than too few!
- 6 Write down, with units if necessary, the result from your calculator (to the required accuracy).

Example 1

x and y are linked by the formula $y = \frac{x^2 + 1}{2\sqrt{x+1}}$.

Find y when x is 3.1

Answer

$$y = \frac{3.1^2 + 1}{2\sqrt{3.1+1}}$$

Write the formula with 3.1 instead of x .

$$y = 2.62$$

Exercise

- 1 If $a = 2.3$, $b = 4.1$ and $c = 1.7$, find d where $d = \frac{3a^2 + 2\sqrt{b}}{ac + b}$
- 2 If $b = 8.2$, $c = 7.5$ and $A = 27^\circ$, find a where $a = \sqrt{b^2 + c^2 - 2bc \cos A}$
- 3 If $u_1 = 10.2$, $r = 0.75$ and $n = 14$, find the value of S , where $S = u_1 \frac{1 - r^n}{1 - r}$

Answers

- 1** 2.487
- 2** 3.728
- 3** 40.073

Simple probabilities

$$\text{Probability} = \frac{\text{number of favourable outcomes}}{\text{total number of possible outcomes}}$$

Example

Julia, Liz, Stevie, Alexandra, Oliver, Elspeth, Hayley and Carolyn work together in the Mathematics department of a school. Find the probabilities:

a $P(\text{woman})$ **b** $P(\text{name starts with vowel})$ **Answer**

a $P(\text{woman}) = \frac{6}{8} = \frac{3}{4} = 0.75$

b $P(\text{name starts with vowel}) = \frac{3}{8} = 0.375$

Exercise

Find:

- 1** $P(\text{orange pencil})$
- 2** $P(\text{pencil in a cold color})$
- 3** $P(\text{yellow pencil})$

Answers

1 $P(\text{orange pencil}) = \frac{2}{13}$

2 $P(\text{pencil in a cold color}) = \frac{5}{13}$

3 $P(\text{yellow pencil}) = \frac{1}{13}$

Equations of lines

A straight line is defined by a linear equation of the form.

$$y = mx + c$$

Gradient y-intercept

This is called the gradient-intercept form.

Example 1

Find the equation of the line with gradient 3 passing through (0, 4)

Answer

The line is $y = 3x + 4$ *The y-intercept is 4. The gradient is 3.*

Exercise

1 Find the equation of each line

a gradient 4 passing through (0, 6)

b gradient -2 passing through (0, 2)

c gradient $\frac{1}{3}$ passing through (0, -5)

d gradient $-\frac{2}{5}$ passing through $\left(0, \frac{4}{5}\right)$

2 State the gradient and y-intercept of each line.

a $y = 3x$

b $y = -5x + 4$

c $y = \frac{1}{2}x - 8$

d $y = 3(x - 3)$

Answers

- 1** **a** $y = 4x + 6$ **b** $y = -2x + 2$ **c** $y = \frac{1}{3}x - 5$ **d** $y = -\frac{2}{5}x + \frac{4}{5}$
- 2** **a** gradient 3, y -intercept (0, 0) **b** gradient -5, y -intercept (0, 4)
- c** gradient $\frac{1}{2}$, y -intercept (0, -8) **d** gradient 3, y -intercept (0, -9)

Solving quadratic equations by using the quadratic formula

You can solve a quadratic equation $ax^2 + bx + c = 0, a \neq 0$ by using the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Example 1

Solve the quadratic equation $x^2 + 3x - 1 = 0$ by using the quadratic formula.

Answer

$$a=1, b=3, c=-1$$

write the values of a, b and c

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-1)}}{2(1)} = \frac{-3 \pm \sqrt{9+4}}{2} = \frac{-3 \pm \sqrt{13}}{2}$$

substitute the values of a, b and c into the formula and simplify

$$x_1 = \frac{-3 + \sqrt{13}}{2} = 0.3$$

$$x_2 = \frac{-3 - \sqrt{13}}{2} = -3.3$$

separate the two solutions

Exercise

Solve these quadratic equations by using the quadratic formula.

1 $4x^2 + 8x - 1 = 0$

2 $-x^2 + 2x = -5$

3 $-3x^2 = -6x + 3$

4 $2x^2 + 23 = 14x$

Answers

1 $x_1 = -1 - \frac{\sqrt{5}}{2}$ and $x_2 = \frac{\sqrt{5}}{2} - 1$

2 $x_1 = 1 - \sqrt{6}$ and $x_2 = 1 + \sqrt{6}$

3 $x = 1$

4 $x_1 = \frac{7 - \sqrt{3}}{2}$ and $x_2 = \frac{7 + \sqrt{3}}{2}$

Solving quadratic equations by completing the square

Example 1

Solve the quadratic equation $x^2 + 4x - 5 = 0$ by completing the square.

Answer

$$x^2 + 4x - 5 = 0 \text{ so } x^2 + 4x = 5 \quad \text{bring the constant to the right-hand side}$$

$$x^2 + 4x + 4 = 5 + 4$$

complete the square on the left-hand side and add the constant to the right-hand side

$$(x + 2)^2 = 9 \quad \text{write the trinomial as a square of a binomial}$$

$$x + 2 = \pm 3 \quad \text{take the square root of both sides}$$

$$x = -2 \pm 3 \quad \text{solve for } x$$

$$x = -2 + 3 = 1 \text{ or } x = -2 - 3 = -5 \quad \text{separate both solutions}$$

Example 2

Solve the quadratic equation $2x^2 - 4x = 3$ by completing the square.

Answer

$$2x^2 - 4x = 2(x^2 + 2) = 3 \quad \text{take out a factor of 2 from the first two terms}$$

$$x^2 - 2 = \frac{3}{2} \quad \text{divide both sides by 2}$$

$$x^2 - 2x + 1 = \frac{3}{2} + 1$$

complete the square on the left-hand side and add the constant to the right-hand side

$$(x - 1)^2 = \frac{5}{2} \quad \text{write the trinomial as a square of a binomial}$$

$$x - 1 = \pm \sqrt{\frac{5}{2}} = \pm \frac{\sqrt{10}}{2} \quad \text{take the square root of both sides}$$

$$x = 1 \pm \frac{\sqrt{10}}{2} \quad \text{solve for } x$$

$$x = 1 + \frac{\sqrt{10}}{2} \text{ or } x = 1 - \frac{\sqrt{10}}{2} \quad \text{separate both solutions}$$

Example 3

Solve the quadratic equation $x^2 + 2x = -4$ by completing the square.

Answer

$$x^2 + 2x + 1 = -4 + 1$$

complete the square on the left-hand side and add the constant to the right-hand side

$$(x + 1)^2 = -3 \quad \text{you cannot take the square root of the right-hand side}$$

No solution

Some quadratic equations have no real solutions.

Exercise

Solve these quadratic equations by completing the square.

1 $x^2 + 4x = 3$

2 $x^2 + 3x = 2$

3 $2x^2 - 2x = 1$

4 $3x^2 + 6x = -2$

Answers

1 $x = -2 - \sqrt{7}$ or $x = \sqrt{7} - 2$

2 $x = -\frac{3}{2} - \frac{\sqrt{17}}{2}$ or $x = \frac{\sqrt{17}}{2} - \frac{3}{2}$

3 $x = \frac{1}{2} - \frac{\sqrt{3}}{2}$ or $x = \frac{1}{2} + \frac{\sqrt{3}}{2}$

4 $x = -1 - \frac{1}{\sqrt{3}}$ or $x = \frac{1}{\sqrt{3}} - 1$

Exponential expressions

Repeated multiplication can be written as an exponential expression.

For example, squaring a number $3 \times 3 = 3^2$ or $5.42 \times 5.42 = 5.42^2$.

If we multiply a number by itself three times then the exponential expression is a cube. For example

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You can also use exponential expressions for larger integer values.

So, for example, $3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$.

Where the exponent is not a positive integer, these rules apply:

$$a^0 = 1, a \neq 0 \text{ and } a^{-n} = \frac{1}{a^n}$$

Example

Write down the values of 10^2 , 10^3 , 10^1 , 10^0 , 10^{-2} , 10^{-3} .

Answer

$$10^2 = 10 \times 10 = 100$$

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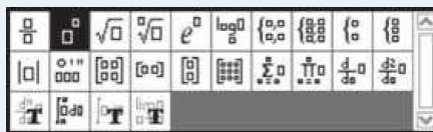
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Exercise

Evaluate these expressions.

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b $4^2 \times 3^2$

c 2^6

2 a 5^0

b 3^{-2}

c 2^{-4}

3 a 3.5^5

b 0.495^{-2}

c $2 \frac{(1 - 0.02)^{10}}{1 - 0.02}$

Answers**1 a** 17**b** 144**c** 64**2 a** 0**b** $\frac{1}{9}$ **c** $\frac{1}{16}$ **3 a** 525.219**b** 4.081**c** 2.488

Percentages

A percentage is a way of expressing a fraction or a ratio as part of a hundred.

For example 25% means 25 parts out of 100.

As a fraction, $25\% = \frac{25}{100} = \frac{1}{4}$.

As a decimal, $25\% = 0.25$.

Example 1

Lara's mark in her maths test was 25 out of 40. What was her mark as a percentage?

Answer

$$\frac{25}{40} \times 100 = 62.5\%$$

Write the mark as a fraction.

Multiply by 100.

Use your GDC.

Example 2

There are 80 students taking the IB in a school. 15% take Maths Standard level. How many students is this?

Answer

Method 1:

$$\frac{15}{100} \times 80 = 12$$

Write the percentage as a fraction out of a hundred and then multiply by 80.

Method 2:

$$15\% = 0.15$$

Write the percentage as a decimal.

$$0.15 \times 80 = 12$$

Multiply by 80.

Exercise

1 Write as percentages

a 13 students from a class of 25

b 14 marks out of 20

2 Find the value of

a 7% of 32 CHF

b 4.5% of 12.00 GBP

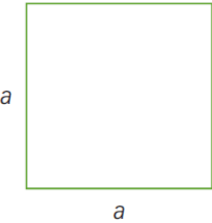
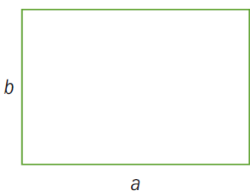
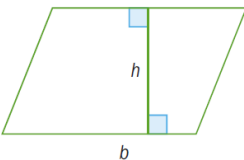
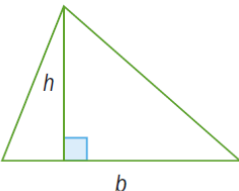
c 25% of 750.28 EUR

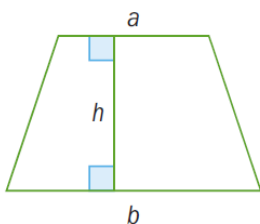
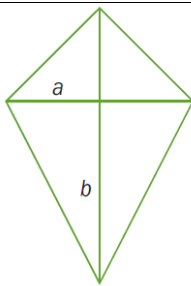
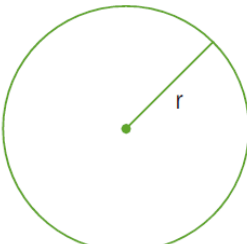
d 130% of 8000 JPY

Answers**1 a** 52% **b** 70%**2 a** 2.24 CHF **b** 0.54 GBP **c** 187.57 EUR **d** 10400 JPY

Area

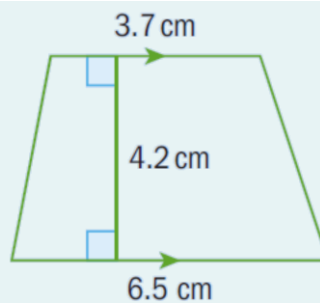
These are the formulae for the areas of a number of plane.

Square	Rectangle	Parallelogram	Triangle
			
$A = a^2$	$A = ab$	$A = bh$	$A = \frac{1}{2}bh$

Trapezium	Kite	Circle
		
$A = \frac{1}{2}(a+b)h$	$A = \frac{1}{2}ab$	$A = \pi r^2$

Example 1

Find the area of this shape.

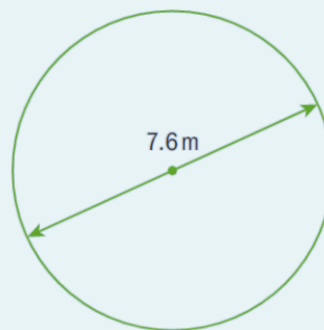


Answer

$$\text{Area} = \frac{1}{2}(3.7 + 6.5)(4.2) = 21.42 \text{ cm}^2$$

Example 2

Find the area of this shape giving your answer to 3 significant figures.



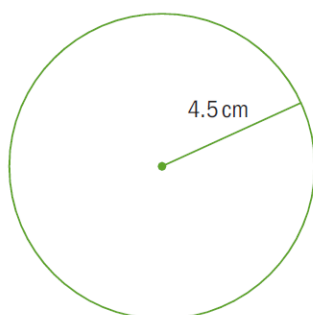
Answer

$$\text{Area} = \pi(7.6)^2 = 181 \text{ cm}^2 \text{ (3 sf)}$$

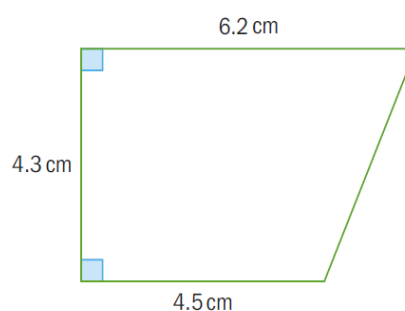
Exercise

Find the areas of these shapes. Give your answer to 3 significant figures.

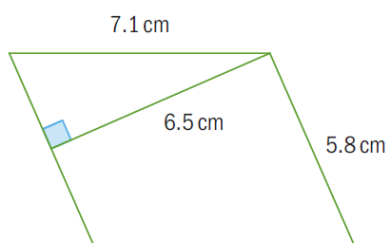
1



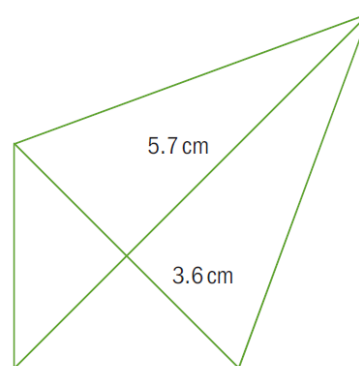
2



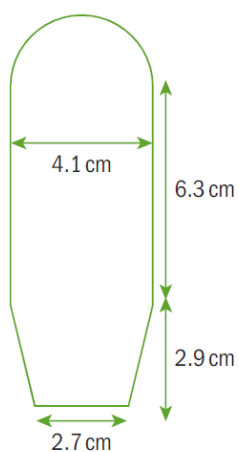
3



4



5

**Answers****1** 63.6 cm^2 **2** 23.0 cm^2 **3** 37.7 cm^2 **4** 20.5 cm^2 **5** 42.3 cm^2

Measures of central tendency

A measure of central tendency, or average, describes a typical value for a set of data.

There are three common types of average:

- The mode - this is the data value that occurs most often.
- The median - this is the middle item when the data is arranged in order of size.
- The mean - this is what most people mean when they use the word "average". It is found by adding up all of the data and dividing by the number of pieces of data.

Example 1

Find **a** the mode **b** the median and **c** the mean of this data set:

2, 5, 4, 9, 1, 3, 2, 6, 9, 2, 5, 1, 3, 4

Answers

a The mode is 2

2 occurs the most often

b 1, 2, 2, 2, 3, 4, 4, 5, 5, 6, 9, 9, 1, 3

Write them in order and find the middle one

The median is 4

c Mean = $\frac{1 + 2 + 2 + 2 + 3 + 4 + 4 + 5 + 5 + 6 + 9 + 9 + 13}{13}$

Add them all together. There

$$= \frac{65}{13} = 5$$

are 13 pieces of data, so divide by 13.

Exercise

1 Find **a** the mode **b** the median and **c** the mean of

a 1, 4, 1, 5, 6, 7, 3, 1, 8

b 4, 7, 5, 12, 5, -3, -2

c 2, 3, 8, 2, 1, 7, 9, 8, 5

d 25, 28, 29, 21, 25, 20, 27

e 7.4, 10.2, 12.5, 6.8, 10.2

2 Fifteen students were asked how many brothers and sisters they had. The results were:

2, 2, 1, 0, 3, 5, 2, 1, 1, 0, 1, 4, 1, 0, 2.

Find **a** the mode, **b** the median and **c** the mean number of brothers and sisters.

3 My last nine homework scores, marked out of 10, were:

8, 7, 9, 10, 8, 9, 6, 8, 7

Find **a** the mode **b** the median and **c** the mean homework score.

- 4** A sprinter's times in seconds for the 40 m dash were:

5.1 3, 4.82, 5.25, 4.94, 5.06, 4.82, 5.12

Find **a** the mode, **b** the median and **c** the mean of the times.

- 5** Seven farmers own different numbers of chickens.

These numbers are:

253, 78, 497, 166, 710, 497 and 599

Find **a** the mode, **b** the median and **c** the mean number of chickens.

Answers

- 1 a** mode=1, median=4, mean=4
b mode=5, median=5, mean=4
c mode=2 and 8, median=5, mean=5
d mode=25, median=25, mean=25
e mode=10.2, median=10.2, mean=9.42
- 2 a** 1 **b** 1 **c** 1 .67
3 a 8 **b** 8 **c** 9
4 a 4.82 **b** 5.06 **c** 5.02
5 a 497 **b** 497 **c** 400