

Literacy

Impossible
Certain
Event
Outcome
Equally likely

On the first day of
Christmas...

Probability

Notation

Mathematicians write the probability of an event as:

$$P(\text{event}) = \dots$$

The event being the outcomes you want to happen.

Skills

1. If there are 4 blue, 5 green, 7 yellow and 9 pink beads in a bag.

Work out the probability of picking

a) yellow b) blue or green c) not blue

2. What is the probability of picking a vowel from the letters MATHEMATICIAN?

3. Which outcome is more likely - rolling a prime number on an ordinary 6 sided dice or rolling a square number?

4. The probability I pass a test is 0.8, what is the probability I fail?

5. There are red, blue and green counters in a bag, $P(\text{red}) = 0.45$, $P(\text{blue}) = 0.2$. What is the probability of picking green?

Stretch

1. The probability I am late to work is 0.6.

Out of 5 working days, how many can I expect to be late?

2.



Two ordinary dice are rolled.

a) What is the probability of the total on the dice being more than 8?

b) What is the probability the total of the two dice is less than 2?

c) What is the probability of rolling a double?

Literacy

Relative frequency
Mutually exclusive
Exhaustive

On the second day of
Christmas...

Probability 2

Memory

The probabilities of mutually exclusive outcomes should add up to 1.

Skills

	Red	Green	Blue	Pink
Probability	0.5	0.01	0.22	

1. What is the probability that the spinner will land on red **or** pink?

	Red	Green	Blue
Probability		0.25	0.05

2. If I spin this spinner 80 times, how many times would you expect it to land on red?

	Red	Green	Blue	Pink
Probability	0.5	x	0.22	x

3. Find x.

If I spin the spinner 120 times, how many times would you expect it to land on Green **or** Blue?

Stretch

- Mary plays a game of throwing a ball at a target. In the game, you can score 0, 1 or 2. The probability that she scores 0 is 0.4. She is twice as likely to score 1 as 2. What is the probability she **does not** score 2?
- There are only red counters, yellow counters, blue counters and green counters in a bag. They are in the ratio 1:2:3:4. Find the probability of picking each colour from the bag.
- There are only blue, green and red counters in a bag. There are twice as many green counters as red counters. There are twice as many blue counters as green counters. What is the probability of **not** picking a red counter?

Literacy

Radius
Diameter
Area
Circumference

On the third day of
Christmas...

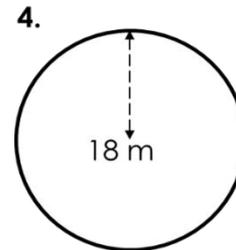
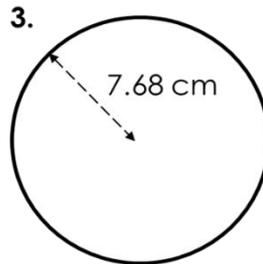
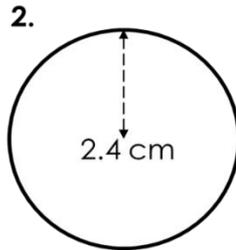
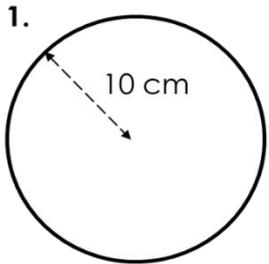
Area of a circle

Memory

$$A = \pi r^2$$

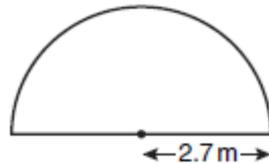
$$C = \pi d$$

Skills

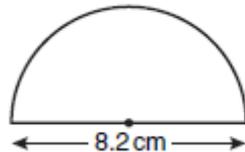


For each of the circles above find their area. Round your answers to 1 decimal place.

5. Find the area of this semi circle
Give your answer to 3 sf.



6. Find the area of this semi circle
Give your answer to 2 dp.



Stretch

A circular pond is surrounded by paving. The pond has a radius of 1m and the paving has a radius of 2m.

Find the area of paving rounded to 1 decimal place.



Literacy

Chord
Tangent
Arc
Segment
Sector

On the fourth day of
Christmas...

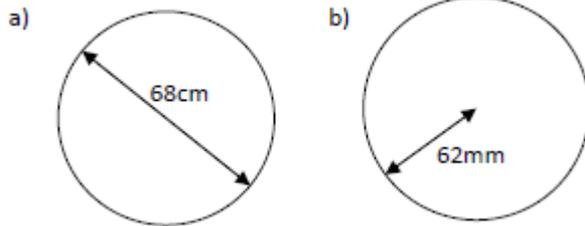
Area of a circle 2

Memory

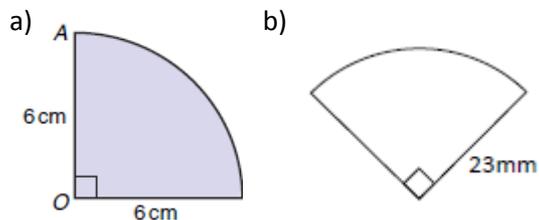
How can you describe a sector and a segment by referring to some of your favourite festive food?

Skills

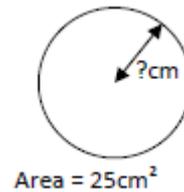
1. Find the area of these circles.



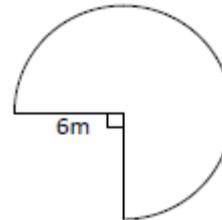
3. Find the area of these quadrants.



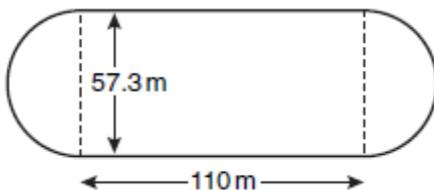
2. Find the radius of the circle.



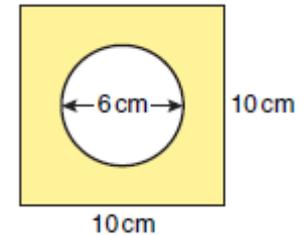
4. Find the area of this shape.



5. Find the area inside this running track to the nearest m^2 .



Stretch



1. The diagram shows a circle of diameter of 6cm inside a square of side 10cm. Give the area of the shaded section in terms of π .

2. Emma is varnishing the top of a circular table with diameter 3.2m. One tin of varnish will cover an area of 2.5m^2 . How many tins of varnish will she need to buy?

Literacy

Mean
Median
Mode
Range
Midpoint

On the fifth day of Christmas... Grouped frequency

Memory

Mean $\rightarrow \frac{\sum fx}{\sum f}$ where x is the midpoint

Modal class interval \rightarrow group with highest frequency

Median \rightarrow group containing middle value $\frac{\sum f}{2}$

Skills

Height, h , cm.	Frequency
$0 < h \leq 4$	1
$4 < h \leq 8$	3
$8 < h \leq 12$	15
$12 < h \leq 16$	19
$16 < h \leq 20$	7

1. At a nursery the heights of seedlings were measured and recorded.

a) What is the modal class interval?

b) Calculate an estimate for the mean.

2. Times taken to run the 1500m by athletes are shown in the grouped frequency table.

a) What is the modal class interval?

b) Find the interval containing the median.

Time, t , secs.	Frequency
$240 < t \leq 250$	3
$250 < t \leq 260$	18
$260 < t \leq 270$	24
$270 < t \leq 280$	56
$280 < t \leq 290$	72
$290 < t \leq 300$	27

Stretch

Thirty people were asked for their height in cm. The results are below.

137 215 148 196 154 83 127
184 157 89 93 112 207 194
175 167 174 164 173 177 140
154 187 176 130 103 178 115
178 184

1) Construct a grouped frequency table for this data.

2) Using the table, estimate the mean, find the modal class interval and the class interval in which the median lies.

Literacy

Median
Quartile
Interquartile range

On the sixth day of Christmas... Cumulative frequency

Memory

Cumulative – increasing by adding the frequencies.

Skills

Height (h cm)	Frequency
$170 \leq h < 175$	5
$175 \leq h < 180$	18
$180 \leq h < 185$	12
$185 \leq h < 190$	4
$190 \leq h < 195$	1

Height (h cm)	Cumulative Frequency
$170 \leq h < 175$	
$170 \leq h < 180$	
$170 \leq h < 185$	
$170 \leq h < 190$	
$170 \leq h < 195$	

1. The table shows information about the heights of 40 bushes.
Complete the cumulative frequency table.

Weight, w, kg.	Frequency
$40 < w \leq 50$	2
$50 < w \leq 60$	15
$60 < w \leq 70$	19
$70 < w \leq 80$	10
$80 < w \leq 90$	1

2. For the table of adult weights
Draw a cumulative frequency table.

Stretch

Size, s, mm.	Frequency
$47 < s \leq 50$	4
$50 < s \leq 53$	36
$53 < s \leq 56$	48
$56 < s \leq 59$	28
$59 < s \leq 62$	8
$62 < s \leq 65$	1

The table shows information about the size of screws made in a factory.

Create a cumulative frequency table from it.

Literacy

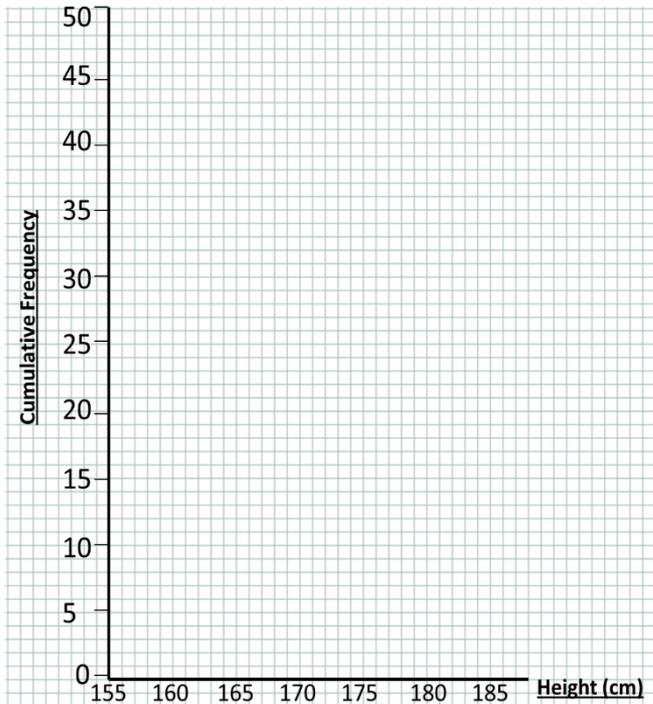
Median
Quartile
Interquartile range

On the seventh day of Christmas... Cumulative frequency 2

Memory

Cumulative – increasing by adding the frequencies.

Skills



Complete the cumulative frequency table and then plot the cumulative frequency curve on the axes.

Height (cm)	Frequency
$155 \leq h < 160$	2
$160 \leq h < 165$	6
$165 \leq h < 170$	14
$170 \leq h < 175$	19
$175 \leq h < 180$	8
$180 \leq h < 185$	1

Height (cm)	Cumulative Frequency
$155 \leq h < 160$	
$155 \leq h < 165$	
$155 \leq h < 170$	
$155 \leq h < 175$	
$155 \leq h < 180$	
$155 \leq h < 185$	

Stretch

continued ...

Use your cumulative frequency graph to find an estimate for

- the median height
- the interquartile range

A historic house has a doorway with a height of 5 ft 10 inches.

c) use your graph to estimate the proportion of people who would need to mind their head as they went in.

(Hint – convert to cm first)

Literacy

Median
Quartile
Interquartile range

On the eighth day of
Christmas...

Box plot

Memory

Interquartile range = $UQ - LQ$

Skills

- Determine the median and upper and lower quartiles for the following data:
 - 13, 13, 15, 16, 21, 23, 24, 28, 29
 - 3.2, 3.5, 3.6, 3.6, 3.7, 3.8, 4.0, 4.1, 4.1, 5.2, 5.3, 5.6
 - 92, 92, 93, 94, 92, 95, 97, 99, 90, 92, 94, 92, 91
- Draw a boxplot to represent each set of data in question 1.
- A shoe shop assistant took note of the sizes of a popular make of trainers that were sold in her shop last week.

4 4 4.5 5 5 5 5.5 5.5 6 6 6 6.5 6.5 10

Calculate the range and the interquartile range and say why the IQR would be a better indicator of the true spread of the shoe sizes sold last week.

Stretch

A group of people in a local gym counted how many pull-ups each person could do in a two minute period. The results were:

Men: 7 9 9 11 13 13 15 18
18 20 25

Women: 5 5 6 7 7 10 12 12
14 14 15 17

- Calculate the median and quartiles for both groups.
- Use one scale to draw two box plots one above the other.
- Use the boxplots to compare the results (you must comment on who performed better and who was more consistent).

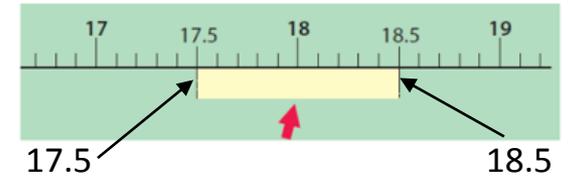
Literacy

Upper bound
Lower bound

On the ninth day of
Christmas...

Error intervals

Memory



The number line shows the upper and lower bounds of 18 rounded to the nearest whole number

Skills

1. Natalia rounds a number, m , to 2 decimal places. The result is 8.61. Complete the error interval for m .

Answer $\underline{\hspace{2cm}} \leq m < \underline{\hspace{2cm}}$

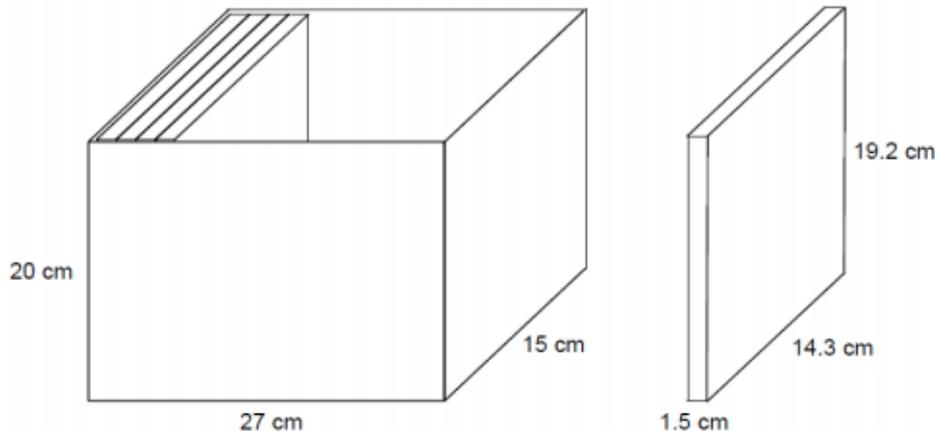
2. Jamal rounds a number, u , to the nearest 100. The result is 30500.

Complete the error interval for u .

Answer $\underline{\hspace{2cm}} \leq u < \underline{\hspace{2cm}}$

3. Paul won a race with a time of 71.3 seconds. This time, t , is given to the nearest tenth of a second.

Write down the error interval for t .



Stretch

A box is a cuboid with dimensions 27 cm by 15 cm by 20 cm. These dimensions are to the nearest centimetre. DVD cases are cuboids with dimensions 1.5 cm by 14.3 cm by 19.2 cm. These dimensions are to the nearest millimetre.

Show that 17 DVD cases, stacked as shown, will definitely fit in the box.

Literacy

Maximum
Minimum
Significant figures

On the tenth day of
Christmas...

Bounds

Memory

To calculate the upper bound of something, you don't always use the upper bounds of each measurement

Skills

1. Complete the table with the lower and upper bounds.

Value	Rounded to	Lower bound	Upper bound
42	2 sf	41.5	42.5
37.28	4 sf		
2000	1 sf		
-5.6	2 sf		

2. A triangle has base, $b = 3\text{cm}$ and height, $h = 4\text{cm}$, both correct to 1 significant figure.

Find the upper and lower bounds for the area of the triangle.

3.

$$X = 32.1 \text{ (3 sf)}$$

$$Y = 2.3 \text{ (2 sf)}$$

$$Z = 20 \text{ (2 sf)}$$

Find the upper and lower bounds of the expression

$$\frac{X - Y}{2Z}$$

Stretch

Joe rides his motorbike 10.7 miles correct to to 1 decimal place. It takes him 8 minutes to the nearest minute.

Work out the upper bound of his speed

a) in miles per minute

b) in miles per hour



Literacy

Bearing
Sine
Cosine
Tangent

On the eleventh day of Christmas... Further trigonometry

Memory

sine rule

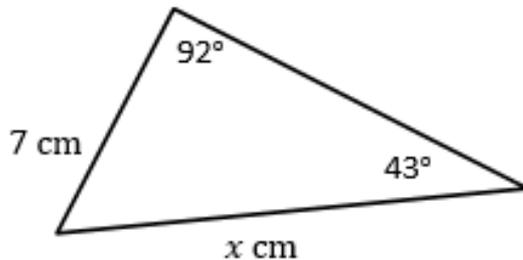
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

cosine rule

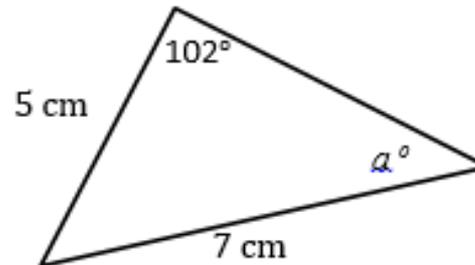
$$a^2 = b^2 + c^2 - 2bc \cos A$$

Skills

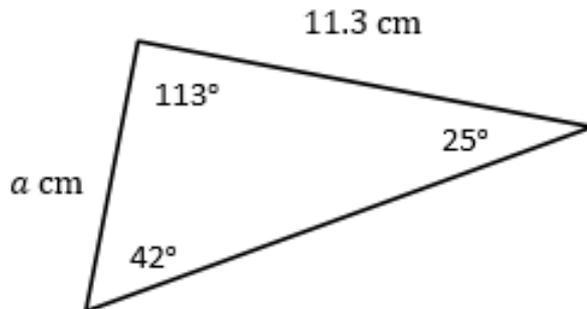
1. Find x .



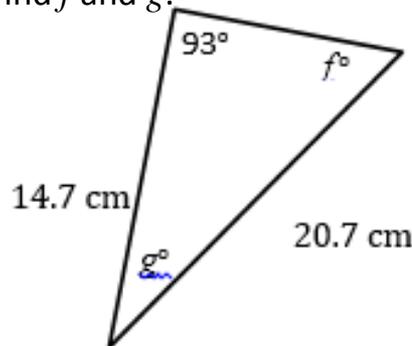
3. Find a .



2. Find a .



4. Find f and g .



Stretch

Two ships leave a port at 13:00. Ship A travels on a bearing of 075° at a speed of 12 km/h . Ship B travels on a bearing of 110° at a speed of 30 km/h .

- How far apart are the ships at 15:30?
- What is the bearing of ship A from ship B at that time?

How close is your answer if you check this by construction rather than calculation?

Literacy

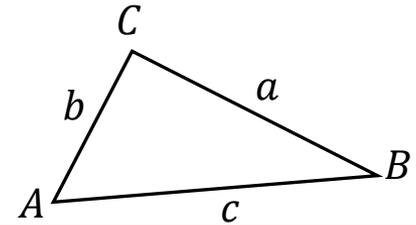
Bearing
Sine
Cosine
Tangent

On the twelfth day of
Christmas...

Further trigonometry 2

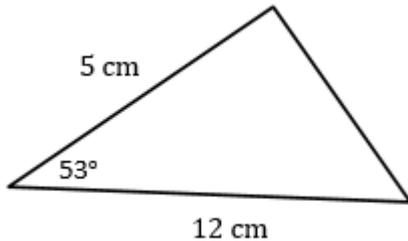
Memory

Area of a triangle = $\frac{1}{2}ab \sin C$

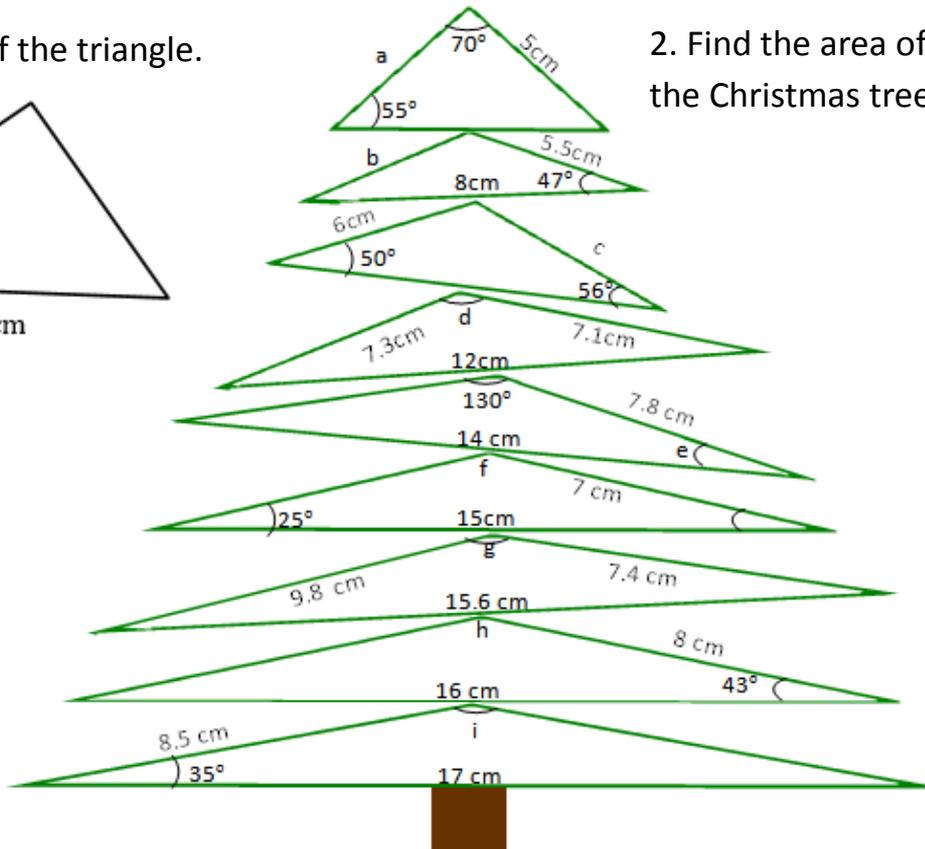


Skills

1. Find the area of the triangle.



2. Find the area of
the Christmas tree.



Stretch

A triangle has a perimeter of 384 m.
The length of the sides are in the
ratio 7:8:9

- calculate the size of the largest angle.
- calculate the area of the triangle.