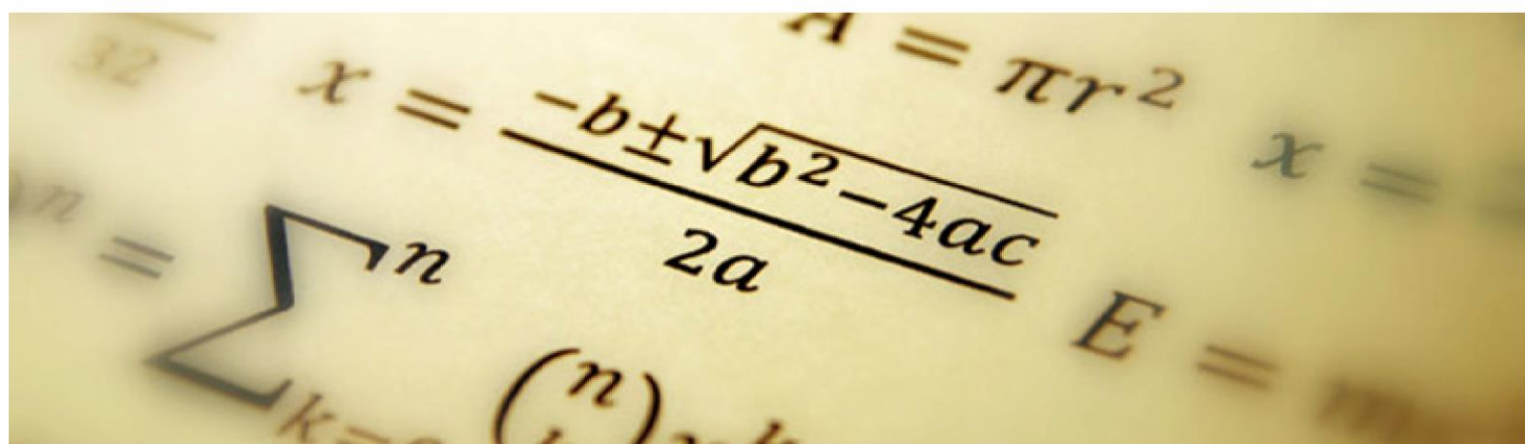




Knowledge Organiser *Maths*

Year 10 – Term 4

Additional Maths



Contents of Study

Lesson	Big Question
16	How can I solve angle questions with algebra?
17	What is surface area on a cube and cuboid?
18	What is surface area on other prisms?
19	How do I find the volume of a cube and cuboid?
20	How do I find the volume of other prisms?
21	Is there a way to list all possible outcomes of events in a compact format?
22	How can I show information for two categories in the same table?
23	How do I complete a frequency tree?
24	What is a Venn Diagram and how do I read them?
25	What is the difference between relative frequency and expected frequency?
26	How do I construct a pie chart?
27	What can I deduce from a pie chart?

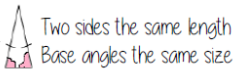
Lessons 1 - 5

Triangles



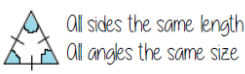
All interior angles in a triangle add up to 180°

Isosceles Triangles



Two sides the same length
Base angles the same size

Equilateral Triangles



All sides the same length
All angles the same size

Look for combinations of angle rules in triangles.
Dash notation indicates equal length sides.

Quadrilaterals



All interior angles in a quadrilateral add up to 360°

Rhombus

All sides equal size
Opposite angles are equal

Kite

No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

Trapezium

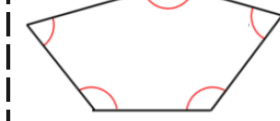
One pair of parallel lines

Polygons

(number of sides $- 2$) $\times 180$

Interior Angles

The angles enclosed by the polygon

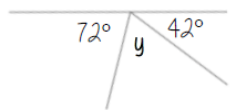


This is an irregular polygon
- the sides and angles are different sizes

Remember this is all of the interior angles added together

Calculating missing angles

Adjacent angles that share a common point on a line add up to 180°



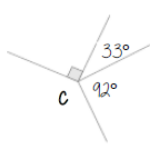
72	y	42
----	---	----

$$72 + y + 42 = 180$$

$$180 - 72 - 42 = y$$

$$66 = y$$

The sum of angles around a point is 360°



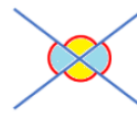
33	90	92	c
----	----	----	---

$$33 + 90 + 92 + c = 360$$

$$360 - 90 - 92 - 33 = c$$

$$c = 155$$

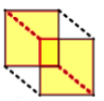
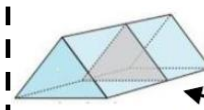
Vertically opposite angles are equal



Opposite angles made from straight lines connecting are equal size

Recognise prisms

A solid object with two identical ends and flat sides

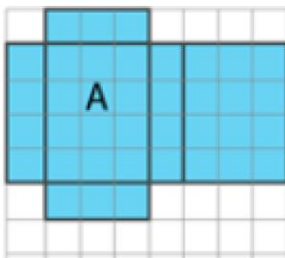
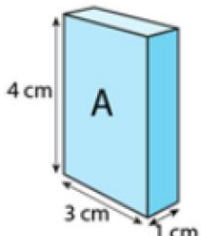


The cross section will also be identical to the end faces.



A cylinder although with very similar properties does not have flat faces so is not categorised as a prism

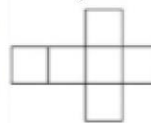
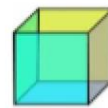
Nets of cuboids



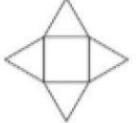
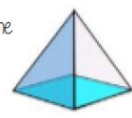
1cm grids help to draw accurately

Visualise the folding of the net.
Will it make the cuboid with all sides touching

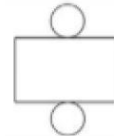
Sketch and recognise nets



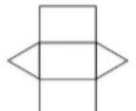
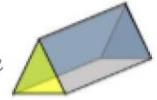
Do they have the same number of faces?



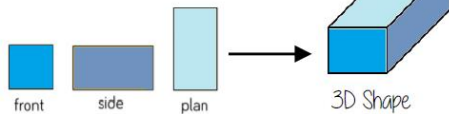
Where do the edges join?



Are the shapes of the faces correct?



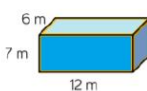
Plans and elevations



The direction you are considering the shape from determines the front and side views

Surface area

Sketching nets first helps you visualise all the sides that will form the overall surface area



For cubes and cuboids you can also find one of each face and double it.



Sides	6×7
	6×7
Front and back	12×7
	12×7
Top and Bottom	12×6
	12×6

Sum of all sides is surface area



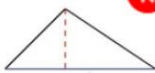
For other shapes - not all the sides are the same, so calculate the individually

Area of 2D shapes

Rectangle
Base \times Height



Triangle
 $\frac{1}{2} \times$ Base \times Perpendicular height

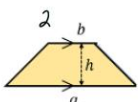


R

Parallelogram/ Rhombus
Base \times Perpendicular height



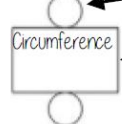
Area of a trapezium
 $\frac{(a+b) \times h}{2}$



Area of a circle
 $\pi \times \text{radius}^2$



Surface area - cylinders



The area of the circle
 $\pi \times \text{radius}^2$

The width of this face is the same as the circumference
 $\pi \times \text{diameter} \times \text{height}$

$$2 \times \pi \times \text{radius}^2 + \pi \times \text{diameter} \times \text{height}$$

Volumes

Volume is the 3D space it takes up - also known as capacity if using liquids to fill the space



Counting cubes

Some 3D shape volumes can be calculated by counting the number of cubes that fit inside the shape.

Cubes/ Cuboids = base \times width \times height

Remember multiplication is commutative



Cross section



Cross section

Prisms and cylinders
= area cross section \times height

Height can also be described as depth

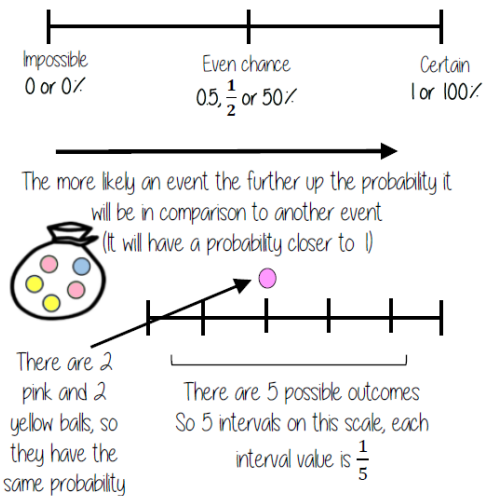
Areas - square units
Volumes - cube units

Areas and volumes can be left in terms of pi π

Lessons 6 - 12

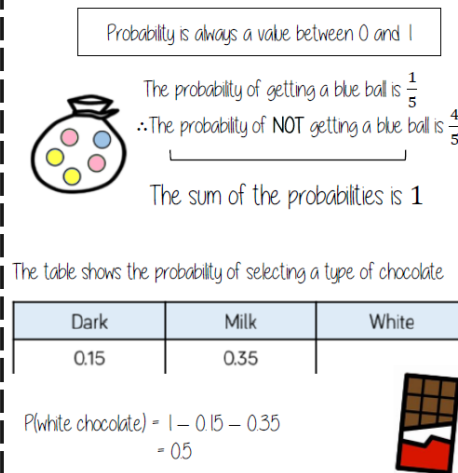
The probability scale

R



Single event probability

R



Relative Frequency

$$\frac{\text{Frequency of event}}{\text{Total number of outcomes}}$$

Remember to calculate or identify the overall number of outcomes!

Colour	Frequency	Relative Frequency
Green	6	0.3
Yellow	12	0.6
Blue	2	0.1
	20	

Relative frequency can be used to find expected outcomes

e.g. Use the relative probability to find the expected outcome for green if there are 100 selections

$$\text{Relative frequency} \times \text{Number of times} \\ 0.3 \times 100 = 30$$

Expected outcomes

Expected outcomes are estimations. It is a long term average rather than a prediction.

Dark	Milk	White
0.15	0.35	0.5

On experiment is carried out 400 times
 Show that dark chocolate is expected to be selected 60 times

The sum of the probabilities is 1

$$0.15 \times 400 = 60$$

Construct sample space diagrams



Sample space diagrams provide a systematic way to display outcomes from events

The possible outcomes from tossing a coin

The possible outcomes from rolling a dice

	1	2	3	4	5	6
H	1H	2H	3H	4H	5H	6H
T	1T	2T	3T	4T	5T	6T

This is the set notation to list the outcomes $S =$

$$S = \{ 1H, 2H, 3H, 4H, 5H, 6H, 1T, 2T, 3T, 4T, 5T, 6T \}$$

In between the $\{ \}$ are a; the possible outcomes

Probability from sample space

The possible outcomes from rolling a dice

The possible outcomes from tossing a coin

	1	2	3	4	5	6
H	1H	2H	3H	4H	5H	6H
T	1T	2T	3T	4T	5T	6T

What is the probability that an outcome has an even number and a tails?

This is the set notation that represents the question P

$$P(\text{Even number and Tails}) = \frac{3}{12}$$

In between the $()$ is the event asked for

There are three even numbers with tails

Numerator: the event

Denominator: the total number of outcomes

There are twelve possible outcomes

Lessons 6 - 12

Identify and represent sets

The **universal set** has this symbol ξ – this means **EVERYTHING** in the Venn diagram is in this set

A set is a collection of things – you write sets inside curly brackets { }

$\xi = \{\text{the numbers between 1 and 50 inclusive}\}$

My sets can include every number between 1 and 50 including those numbers

$A = \{\text{Square numbers}\}$

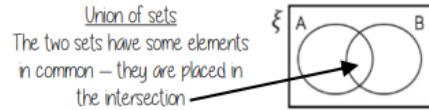
$A = \{1, 4, 9, 16, 25, 36, 49\}$

All the numbers in set A are square number and between 1 and 50

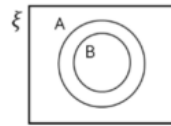
Interpret and create Venn diagrams



Mutually exclusive sets
The two sets have nothing in common
No overlap



Union of sets
The two sets have some elements in common – they are placed in the intersection



Subset
All of set B is also in Set A so the ellipse fits inside the set

The box
Around the outside of every Venn diagram will be a box. If an element is not part of any set it is placed outside an ellipse but inside the box

Intersection of sets

Elements in the intersection are in set A AND set B

The notation for this is $A \cap B$

$\xi = \{\text{the numbers between 1 and 15 inclusive}\}$
 $A = \{\text{Multiples of 5}\}$ $B = \{\text{Multiples of 3}\}$

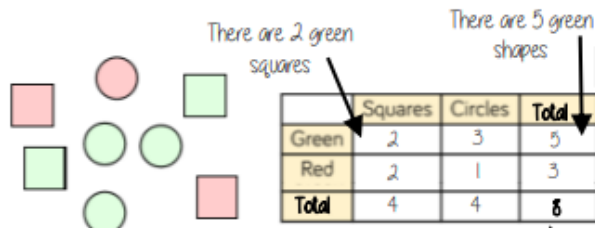


The element in $A \cap B$ is 15

In this example there is only one number that is both a multiple of 3 and a multiple of 5 between 1 and 15

Representing data in two-way tables

Two-way tables represent discrete information in a visual way that allows you to make conclusions, find probability or find totals of sub groups



Using your two-way table

There are 8 items in total

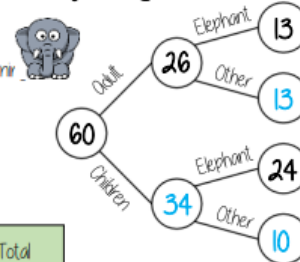
Tables, Venn diagrams, Frequency trees

Frequency trees

60 people visited the zoo one Saturday morning. 26 of them were adults. 13 of the adult's favourite animal was an elephant. 24 of the children's favourite animal was an elephant.

Two-way table

	Adult	Child	Total
Elephant	13	24	37
Other	13	10	23
Total	26	34	60



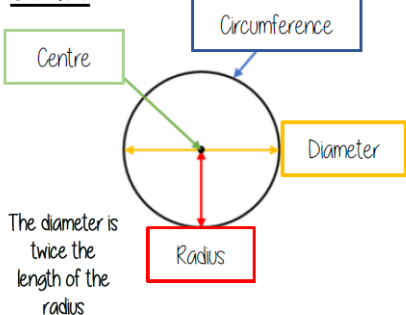
Frequency trees and two-way tables can show the same information

The total columns on two-way tables show the possible denominators

$$P(\text{adult}) = \frac{26}{60}$$

$$P(\text{Child with favourite animal as elephant}) = \frac{13}{37}$$

Circles

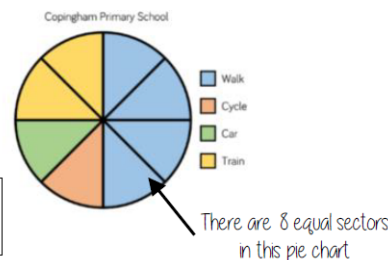


The diameter is twice the length of the radius

Read and interpret pie charts

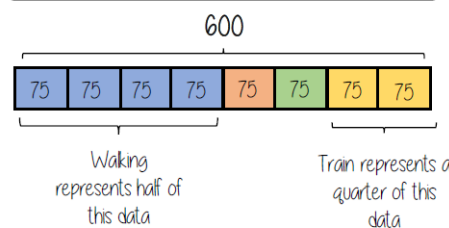
Always read the data for the total amount the pie chart represents

Coppingham Primary School has 600 students



There are 8 equal sectors in this pie chart

This bar model represents the information in the bar chart



Walking represents half of this data

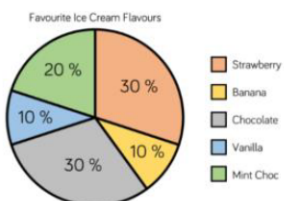
Train represents a quarter of this data

Pie charts with percentages

This survey asked 160 people

The whole pie chart represents 100%

$$10\% = \frac{1}{10} \quad 50\% = \frac{1}{2} \quad 25\% = \frac{1}{4}$$



$$\text{Strawberry } 30\% = \frac{3}{10}$$

$160 \div 10 = 16$
 $16 \times 3 = 48$
This is 10% make other calculations from this value

Draw pie charts

Type of pet	Dog	Cat	Hamster
Frequency	32	25	3

There were 60 people asked in this survey (Total frequency)

$\frac{32}{60}$ "32 out of 60 people had a dog"

This fraction of the 360 degrees represents dogs

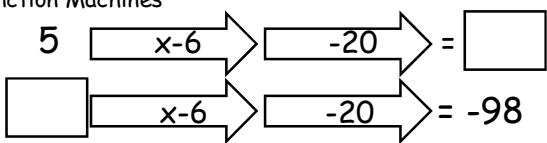
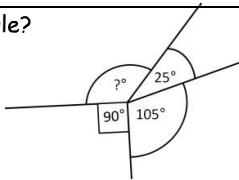
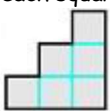
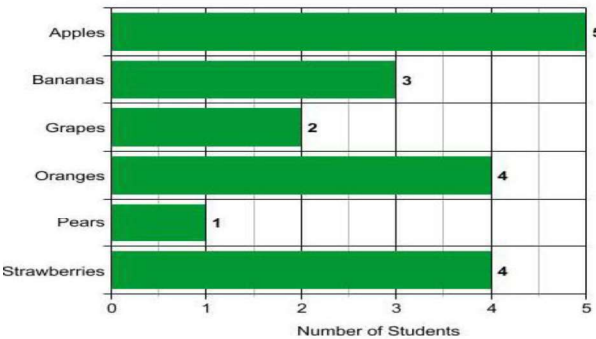
$$\frac{32}{60} \times 360 = 192^\circ$$



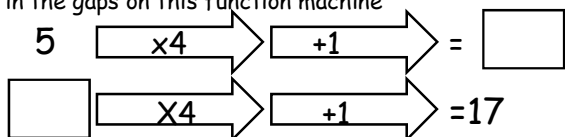
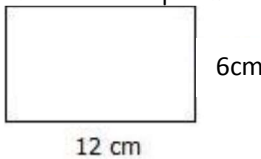
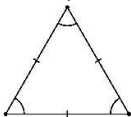
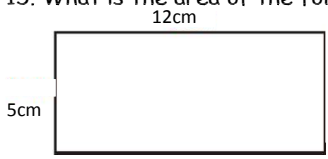
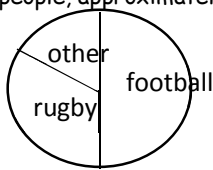
Use a protractor to draw This is 192°

Multiple method
As 60 goes into 360 – 6 times
Each frequency can be multiplied by 6 to find the degrees (proportion of 360)


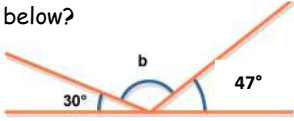
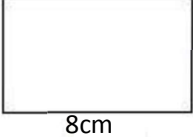













































Mixed Homework Sheet 10

<p>1. $8 \times 6 \div (8 - 6) \times 2$</p>	<p>2. Function Machines</p> 														
<p>3. The ratio of cars to trucks in a parking lot was 4:7. For every _____ cars there were _____ trucks.</p>	<p>4. A rectangle has a perimeter of 24 cm and an area of 35 cm^2. What are the lengths of the shorter side and longer side?</p>														
<p>5. What is the probability of choosing a jack or a queen from a standard deck of 52 playing cards?</p>	<p>6. What is the median of the following set of data? 12 1 10 1 9 3 4 9 7 9</p>														
<p>7. Express 225 as a product of it's prime factors.</p>	<p>8. What are the missing terms in the following sequence? ____, 4, 7, ____, ____, 16</p>														
<p>9. Is the exchange rate is £1 = \$1.82, how many dollars would I get for £560</p>	<p>10. What is the size of the missing angle?</p> 														
<p>11. The weights of six dogs in kilograms are; 12.1, 14.3, 10.8, 14.0, 10.7 and 15.5. Calculate the median weight of the dogs.</p>	<p>12. The probability of a biased coin landing on heads is 0.55. I flip the coin 200 times, how many times would the coin land on heads?</p>														
<p>13. Order the following from smallest to largest. $\frac{7}{9}$, $\frac{2}{3}$, 0.66, 78%</p>	<p>14. Find the value of the following expression if a = 2, b = 5 and c = 9. $5(a + bc)$</p>														
<p>15. What is the area of the following shape if each square is one centimetre wide?</p> 	<p>16. You have a deck of cards. Find the probability of drawing a 7.</p>														
<p>17. In a sale the cost of a computer is reduced by 30%. The normal price of the computer was £900. Calculate the sale price of the computer</p>	<p>18. Solve the following equation $4x + 6 = -10$</p>														
<p>19. What is 4.2m in mm?</p>	<p>20. The bar chart shows students favourite fruit. What is the difference between votes for apples and votes for pears?</p> <p>Students Vote for Favorite Fruit</p>  <table border="1"> <thead> <tr> <th>Fruit</th> <th>Number of Students</th> </tr> </thead> <tbody> <tr> <td>Apples</td> <td>5</td> </tr> <tr> <td>Bananas</td> <td>3</td> </tr> <tr> <td>Grapes</td> <td>2</td> </tr> <tr> <td>Oranges</td> <td>4</td> </tr> <tr> <td>Pears</td> <td>1</td> </tr> <tr> <td>Strawberries</td> <td>4</td> </tr> </tbody> </table>	Fruit	Number of Students	Apples	5	Bananas	3	Grapes	2	Oranges	4	Pears	1	Strawberries	4
Fruit	Number of Students														
Apples	5														
Bananas	3														
Grapes	2														
Oranges	4														
Pears	1														
Strawberries	4														
<p>Total: /20</p>	<p>Personal Target:</p>														

Mixed Topic Homework Sheet 11

1. Calculate $5 \times 7 - 9 =$	2. Fill in the gaps on this function machine 
3. Write the following ratio in its simplest form, 8:24	4. What is the perimeter of the following shape? 
5. If I have 22 shirts and 4 are blue, what is the probability of me choosing a blue shirt?	6. What is the mode of the following set of numbers? 2, 3, 6, 7, 7, 9, 9, 11, 13
7. List 5 different prime numbers between 20 and 40	8. Write the next three terms of the following sequence: 5, 9, 13, 17, _____, _____, _____
9. If I need 70 chocolate chips to make 10 cookies, how many do I need to make 20 cookies?	10. The triangle below is an equilateral triangle, what is the size of each angle and why? 
11. Find the median for the following set of numbers: 12, 15, 15, 16, 19, 21, 25, 27, 32	12. If the probability of choosing a strawberry from a bag of strawberries and apples is 0.35, what is the probability of choosing an apple?
13. Write the following decimals from smallest to largest: 0.013, 0.39, 0.31, 0.45, 0.045, 4.5	14. Simplify $7x + 2y + 3x + 9y$
15. What is the area of the following shape 	16. Write down all the possibilities when rolling a fair six sided die.
17. What is 50% of 170?	18. Write an expression for the total cost of 5 pencils and 6 rubbers.
19. How many metres are in 9.5km?	20. If the pie chart below represents favourite sports of 90 people, approximately how many chose rugby? 
Total: /20	Personal Target:

Mixed Topic Homework Sheet 12

<p>1. Calculate $4 + 9 \div 3 =$</p>	<p>2. Fill in the gaps on this function machine</p> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 10px;"> $5 \xrightarrow{\times 6} \boxed{} \xrightarrow{-3} \boxed{} = \boxed{}$ $\boxed{} \xrightarrow{\times 6} \boxed{} \xrightarrow{-3} \boxed{} = 45$ </div> </div>																
<p>3. If the ratio of gold coins to silver coins is 2:5, how many silver coins would I have if I had 8 gold coins?</p>	<p>4. What is the area of the following shape?</p> <div style="text-align: center; margin-top: 10px;">  </div>																
<p>5. If I have 40 flowers and 5 are red, what is the probability of me not choosing a red flower?</p>	<p>6. What is the median of the following set of numbers? 2, 3, 4, 6, 7, 7, 9</p>																
<p>7. Circle the prime numbers from the list below: 2, 17, 27, 63, 77, 97, 31, 43, 21, 39</p>	<p>8. What is the term to term rule of the following sequence? 52, 48, 44, 40, 36</p>																
<p>9. If I need 60g of flour to make 12 breadsticks, how much flour would I need to make 18 breadsticks?</p>	<p>10. What is the size of the missing angle in the diagram below?</p> <div style="text-align: center; margin-top: 10px;">  </div>																
<p>11. Find the range for the following set of numbers: 12, 15, 15, 16, 19, 21, 25, 31, 37</p>	<p>12. Complete the two way table below. What is the probability a person selected at random liked both star wars and titanic?</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="color: red;">ANSWER</th> <th>Like "Titanic"</th> <th>Dislike "Titanic"</th> <th>Totals</th> </tr> </thead> <tbody> <tr> <td>Like "Star Wars"</td> <td style="text-align: center;">70</td> <td></td> <td></td> </tr> <tr> <td>Dislike "Star Wars"</td> <td style="text-align: center;">50</td> <td style="text-align: center;">50</td> <td></td> </tr> <tr> <td>Totals</td> <td></td> <td></td> <td style="text-align: center;">250</td> </tr> </tbody> </table>	ANSWER	Like "Titanic"	Dislike "Titanic"	Totals	Like "Star Wars"	70			Dislike "Star Wars"	50	50		Totals			250
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<p>13. Write the following fractions in order from smallest to largest: $\frac{1}{5}$ $\frac{1}{8}$ $\frac{2}{9}$ $\frac{3}{8}$ $\frac{4}{5}$</p>	<p>14. Simplify $5e + 9f - 8e - 8f$</p>																
<p>15. What is the perimeter of the following shape</p> <div style="text-align: center; margin-top: 10px;">  </div>	<p>16. Write down all the possibilities when rolling a fair six sided die, and flipping a fair coin.</p>																
<p>17. What is 30% of 180?</p>	<p>18. Write an expression for the total cost of 15 bracelets and 6 watches.</p>																
<p>19. How many millimetres are in 53cm</p>	<p>20. If the pictogram below represents peoples favourite sports, how many chose tennis?</p> <div style="margin-top: 10px;"> <p style="text-align: center; font-size: small;">Sports Played by 3rd Graders</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">football</td> <td>    </td> </tr> <tr> <td>tennis</td> <td>  </td> </tr> <tr> <td>rugby</td> <td>     </td> </tr> <tr> <td colspan="2"> <p style="font-size: x-small;">Key  = 10 students</p> </td> </tr> </table> </div>	football	    	tennis	  	rugby	     	<p style="font-size: x-small;">Key  = 10 students</p>									
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