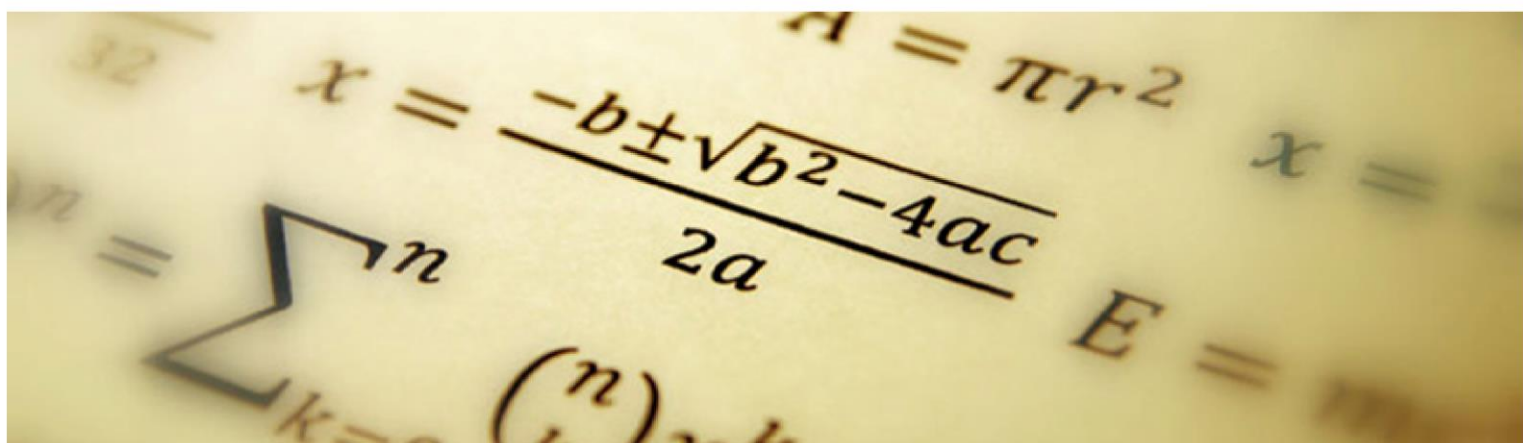




Knowledge Organiser *Maths*

Year 10 – Term 1
Additional Maths



Lesson	Big Question
1	How do I multiply numbers together?
2	How do I divide numbers?
3	How can I apply my multiplication and division skills to problems and what is BIDMAS?
4	How can I calculate with money?
5	How do I tell the time?
6	How do I add and subtract decimal numbers?
7	How do I multiply two decimals together?
8	What is the difference between rounding to decimal places and rounding to significant figures?
9	How do I simplify fractions and how can I put fractions in order?
10	How can I add and subtract fractions?
11	How can I apply my knowledge of fractions to problems?
12	How do I calculate a fraction of an amount?
13	How can I multiply and divide with fractions?
14	What is a percentage?
15	How do I increase and decrease by a percentage?
16	How can I convert between fractions decimals and percentages?
17	How can I calculate percentage change and use multipliers?
18	What are the different number groups?
19	What is a common factor or multiple and what are prime factors?
20	What are indices?

Calculating with positive numbers

When you are unable to complete a calculation mentally use a written method. The most common method for addition, subtraction and multiplication is column method; for division use Bus Stop method.

Examples

$$\begin{array}{r} 789 \\ + 642 \\ \hline 1431 \\ \hline 11 \end{array}$$

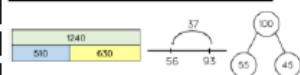
$$\begin{array}{r} 812 \\ - 457 \\ \hline 475 \end{array}$$

$$\begin{array}{r} 24 \\ \times 16 \\ \hline 240 \\ 144 \\ \hline 384 \end{array}$$

$$5 \overline{) 158} \begin{array}{l} 7^2 \\ 9^4 \\ 0 \end{array}$$

When adding or subtraction start with the ones column.

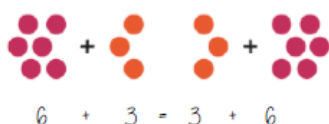
Addition/ Subtraction



Modelling methods for addition/ subtraction

- Bar models
- Number lines
- Part/ Whole diagrams

Addition is commutative



$$6 + 3 = 3 + 6$$

The order of addition does not change the result.

Subtraction the order has to stay the same

$$360 - 147 = 360 - 100 - 40 - 7$$

- Number lines help for addition and subtraction
- Working in 10's first aids mental addition/ subtraction
- Show your relationships by writing fact families

Formal written methods

	H	T	O
+	1	8	7
	5	4	2

	H	T	O
-	4	2	7
	2	4	9

Remember the place value of each column. You may need to move 10 ones to the ones column to be able to subtract.

Decimals have the same methods remember to align the place value

Division methods

$$3584 \div 7 = 512$$

$$\begin{array}{r} 512 \\ 7 \overline{) 3584} \end{array}$$

Complex division

$$\div 24 = \div 6 \div 4$$

Break up the divisor using factors

Division with decimals

The placeholder in division methods is essential – the decimal lines up on the dividend and the quotient.

$$24 \div 0.02 \rightarrow 24 \div 0.2 \rightarrow 240 \div 2$$

All give the same solution as represent the same proportion. Multiply the values in proportion until the divisor becomes an integer.

Multiplication methods

	H	T	O
x	1	8	7
	9		

Long multiplication (column)

x	100	80	7
9			

Grid method

1	8	7
1	8	7
1	8	7
1	8	7
1	8	7
1	8	7
1	8	7
1	8	7

Repeated addition

Less effective method especially for bigger multiplication

Multiplication with decimals

Perform multiplications as integers e.g. $0.2 \times 0.3 \rightarrow 2 \times 3$

Make adjustments to your answer to match the question: $0.2 \times 10 = 2$
 $0.3 \times 10 = 3$

Therefore $6 \div 100 = 0.06$

"To 2dp" – to two numbers after the decimal

2.46192 (to 1dp) – Is this closer to 2.4 or 2.5



2.46192 This shows the number is closer to 2.5

2.46192 (to 2dp) – Is this closer to 2.46 or 2.47



2.46192 This shows the number is closer to 2.46

Estimation

Estimations are useful – especially when using fractions and decimals to check if your solution is possible.

Most estimations round to 1 significant figure

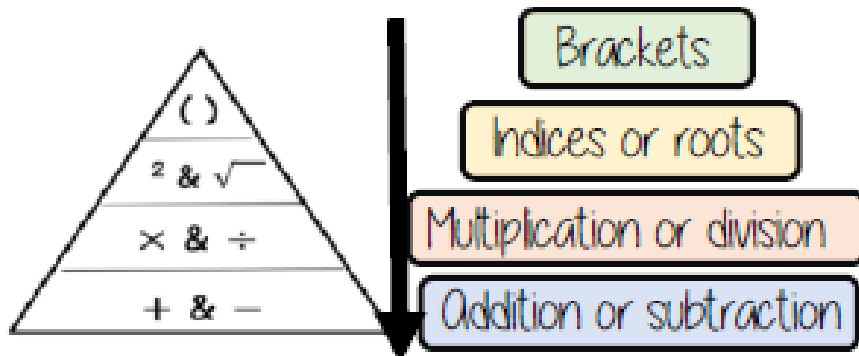
Estimations are useful – especially when using fractions and decimals to check if your solution is possible.

$$210 + 899 < 1200$$

This is true because even if both numbers were rounded up, they would reach $300 + 900$.

The correct estimation would be $200 + 900 = 1100$.

Use order of operations

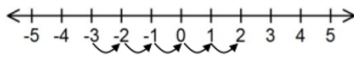


Operations with Negative Numbers

Single Sign - Addition

$$-3 + 5 = 2$$

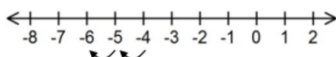
Start on '-3' and count 5 'forwards'



Single Sign - Subtraction

$$-4 - 2 = -6$$

Start on '-4' and count 2 'backwards'



Double Sign - When to add

$$4 - (-5)$$

$$= 4 + 5$$

$$= 9$$

$$-6 - (-2)$$

$$= -6 + 2$$

$$= -4$$

Double Sign - When to Subtract

$$4 + (-5)$$

$$= 4 - 5$$

$$= -1$$

$$-3 + (-2)$$

$$= -3 - 2$$

$$= -5$$

Multiplication

$$+ \times + = +$$

$$+ \times - = -$$

$$- \times + = -$$

$$- \times - = +$$

Division

$$+ \div + = +$$

$$+ \div - = -$$

$$- \div + = -$$

$$- \div - = +$$

Representing Fractions



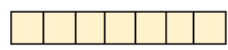
$$\frac{1}{4}$$

is represented in all the images



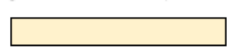
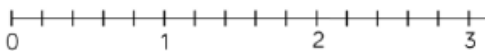
$$1 \div 4$$

Mixed numbers and fractions



$$\frac{7}{5}$$

Improper fraction



$$1\frac{2}{5}$$

Mixed number

In this model 5 parts make up a whole

Fractions can be bigger than a whole

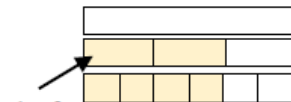
Equivalent fractions

Numerator and denominator have the same multiplier

$$\frac{2}{3}$$

$$=$$

$$\frac{4}{6}$$



$$\frac{1}{3} = \frac{2}{6}$$

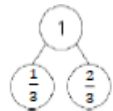
Add/Subtract fractions

Same denominator

$$\frac{2}{7} + \frac{3}{7} = \frac{5}{7}$$



Sequences



$$\frac{1}{3}, 1, 1\frac{2}{3}, 2\frac{1}{3}, 3, \dots$$

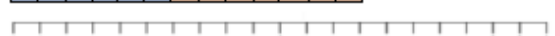
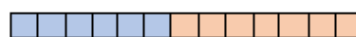
$$\frac{2}{3} + \frac{2}{3}$$

Represent this on a number line to help

Add/Subtraction fractions (common multiples)

Addition/Subtraction needs a common denominator

$$\frac{3}{5} + \frac{7}{10}$$



$$\frac{13}{10}$$

Add/Subtract from integers

$$1 - \frac{2}{6} = \frac{4}{6}$$



$$3 + \frac{1}{6} = 3\frac{1}{6}$$



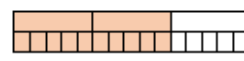
The denominator indicates the number of parts a whole is made up of

Add/Subtraction any fractions

$$\frac{4}{5} - \frac{2}{3}$$



$$\frac{12}{15}$$



$$\frac{10}{15}$$

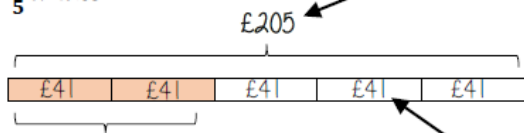
$$= \frac{2}{15}$$

Use equivalent fractions to find a common multiple for both denominators

Fraction of a given amount

Find $\frac{2}{5}$ of £205

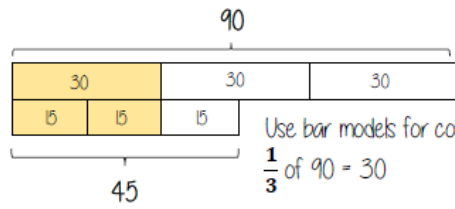
The bar represents the whole amount



2 out of the 5 equal parts
 $2 \times £41 = \underline{£82}$

$$£205 \div 5 = £41$$

Each part of the bar model represents £41



Use bar models for comparisons

$$\frac{1}{3} \text{ of } 90 = 30$$

$$\frac{2}{3} \text{ of } 45 = 30$$

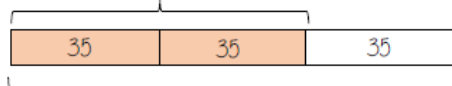
$$\therefore \frac{1}{3} \text{ of } 90 = \frac{2}{3} \text{ of } 45$$

Use a fraction of amount

$\frac{2}{3}$ of a value is 70. What is the whole number?

$$70 \div 2 = 35$$

Each part of the bar model represents 35.



$$35 \times 3 = 105$$

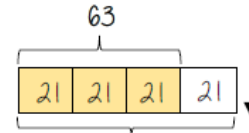
The whole number is 105

The wording of the question is important to setting up the bar model!

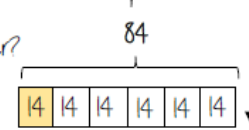
$\frac{3}{4}$ of a number is 63.

What is $\frac{1}{6}$ of the number?

$$= 14$$



Find the whole



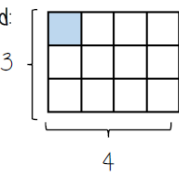
Use the whole to find a given part

Multiplying unit fractions

$$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

Parts shaded

Modelled:



Total number of parts in the diagram

Multiplying non-unit fractions

Shade in 3 parts

Repeat it on this many rows

$$\frac{3}{4} \times \frac{2}{3}$$

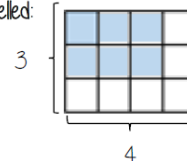
This many columns

This many rows

$$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$$

Parts shaded

Modelled:



Total number of parts in the diagram

Quick Multiplying and Cancelling down

$$\frac{1}{5} \times \frac{4}{9} = \frac{4}{45}$$

The 3 and the 9 have a common factor and can be simplified

Quick Solving

Multiply the numerators

Multiply the denominators

$$\frac{1 \times 4}{5 \times 3} = \frac{4}{15}$$

The reciprocal

When you multiply a number by its reciprocal the answer is always 1

$$3 \times \frac{1}{3} = 1$$

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$$

The reciprocal of 3 is $\frac{1}{3}$ and vice versa

Reciprocals for division

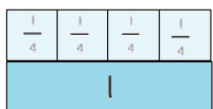
eg

$$5 \div \frac{1}{4} = 20$$

$$5 \times 4 = 20$$

Multiplying by a reciprocal gives the same outcome

Dividing an integer by an unit fraction



$$1 \div \frac{1}{4} = 4$$

How many quarters are in 1?

'There are 4 quarters in 1 whole.

Therefore, there are 20 quarters in 5 wholes'

$$5 \div \frac{1}{4} = 20$$

Dividing any fractions

Remember to use reciprocals

$$\frac{2}{5} \div \frac{3}{4}$$

$$\frac{2}{5} \times \frac{4}{3}$$

Multiplying by a reciprocal gives the same outcome

Represented



$$= \frac{8}{15}$$

Percentages of amounts



50% is the same as one half

To find 50% you need to divide by 2

$$50\% \text{ of } £620 = £310$$

$$£620 \div 2 = £310$$



25% is the same half of 50%

or one quarter

$$25\% \text{ of } £620 = £155$$

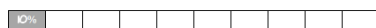
$$£620 \div 2 = £310 \text{ (50\%)} \\ £310 \div 2 = £155$$



75% is the same as 50% + 25%

$$75\% \text{ of } £620 = £310 + £155$$

$$= £465$$



10% is the same as one tenth

To find 10% you need to divide by 10

$$10\% \text{ of } £120 = £12$$



20% is the same 10% + 10% or one fifth

$$20\% \text{ of } £120 = £12 + £12$$

$$= £24$$



5% is the same half of 10%

$$5\% \text{ of } £120 = £12 \div 2$$

$$= £6$$

Converting Fractions, Decimals, Percentages

Divide the numerator by the denominator

Decimals

$\times 100$

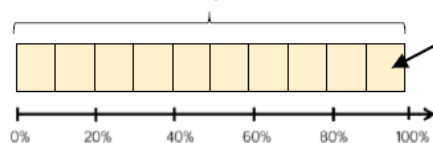
Fractions

Put over 100 and simplify

Percentages

Find the percentage of an amount (Mental methods)

The whole represents 100%



10% = $\frac{1}{10}$ of the whole

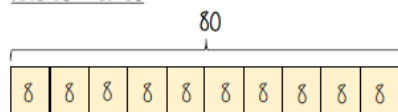
$$10\% = \frac{1}{10} \text{ of the whole}$$

$$50\% = \frac{5}{10} = \frac{1}{2} \text{ of the whole}$$

$$20\% = \frac{2}{10} = \frac{1}{5} \text{ of the whole}$$

$$5\% = \frac{1}{20} \text{ of the whole}$$

Find 65% of 80



Method 1

$$65\% = 10\% \times 6 + 5\% \\ = (8 \times 6) + 4 \\ = 52$$

Method 2

$$65\% = 50\% + 10\% + 5\% \\ = 40 + 8 + 4 \\ = 52$$

For bigger percentages it is sometimes easier to take away from 100%

Find the percentage of an amount (Calculator methods)



Using a multiplier

Find 65% of 80

Fraction, decimal, percentage conversion

$$65\% = \frac{65}{100} = 0.65$$

The multiplier

$$0.65 \times 80 = 52$$

Using the percent button

Find 65% of 80

This brings up the % button on screen
You will see 65%

Type 65

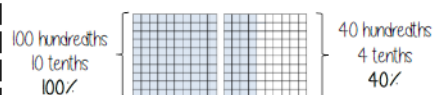
Press **SHIFT** **(%)**

Press **\times** 80 and then press **=**

You can also use the calculator to support non calculator methods and find 1% or 10% then add percentages together

"of" can represent 'x' in calculator methods

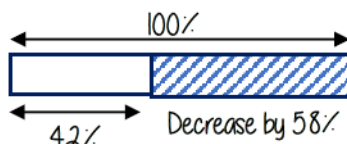
Convert FDP < and > 100%



$$100\% + 40\% \\ 1 + 0.40 \\ = 1.40$$

140 hundredths
14 tenths
140%

Percentage decrease: Multipliers

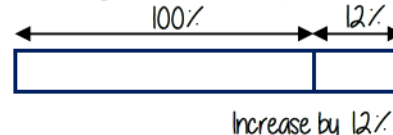


$$100\% - 58\% = 42\%$$

$$100 - 58 = 42$$

Multiplier
Less than 1

Percentage increase: Multipliers



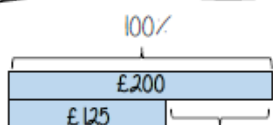
$$100\% + 12\% = 112\%$$

$$100 + 12 = 112$$

Multiplier
More than 1

Percentage change

I bought a phone for £200.
A year later sold it for £125.



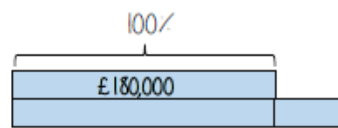
All values of change compare to the ORIGINAL value

Percentage loss

$$\frac{75}{200} \times 100 = 37.5\%$$

$$\frac{\text{Difference in value}}{\text{Original value}} \times 100$$

I bought a house for £180,000, I later sold it for £216,000.



Percentage profit

$$\frac{36000}{180000} \times 100 = 20\%$$

Multiples

The "times table" of a given number

All the numbers in this lists below are multiples of 3.

3, 6, 9, 12, 15...

3x, 6x, 9x ...

This list continues and doesn't end

x could take any value and as the variable is a multiple of 3 the answer will also be a multiple of 3

Non example of a multiple

45 is not a multiple of 3 because it is 3×15

Not an integer

Factors

Arrays can help represent factors

5 x 2 or 2 x 5

Factors of 10
1, 2, 5, 10

10 x 1 or 1 x 10

Factors and expressions

6x x 1 OR 6 x x

The number itself is always a factor

Factors of 6x

6, x, 1, 6x, 2x, 3, 3x, 2

2x x 3

3x x 2

Prime numbers

- Integer
- Only has 2 factors
- and itself

The first prime number
The only even prime number

Learn or how-to quick recall...

2, 3, 5, 7, 11, 13, 17, 19, 23, 29...

Common factors and HCF

1 is a common factor of all numbers

Common factors are factors two or more numbers share

HCF - Highest common factor

HCF of 18 and 30

Common factors

(factors of both numbers)

1, 2, 3, 6

HCF = 6

6 is the biggest factor they share

Common multiples and LCM

Common multiples are multiples two or more numbers share

LCM - Lowest common multiple

LCM of 9 and 12

9 9, 18, 27, 36, 45, 54

12 12, 24, 36, 48, 60

LCM = 36

The first time their multiples match

Comparing fractions

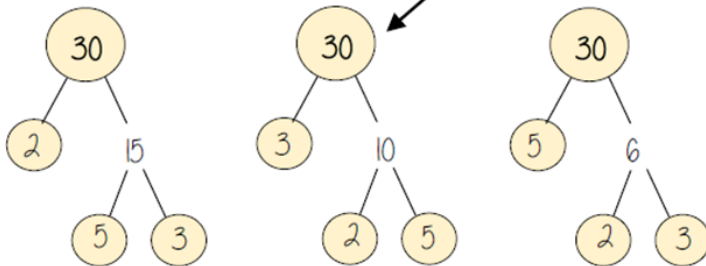
$\frac{3}{5}$ and $\frac{7}{10}$

Compare fractions using a LCM denominator

$\frac{6}{10}$ and $\frac{7}{10}$

Product of prime factors

Multiplication part-whole models



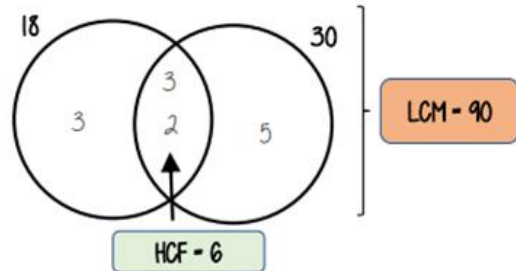
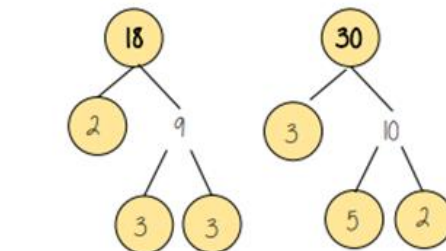
All three prime factor trees represent the same decomposition

Multiplication is commutative

$30 = 2 \times 3 \times 5$

Multiplication of prime factors

Finding the HCF and LCM



Addition/ Subtraction laws for indices

$$3^5 \times 3^2 \rightarrow 3^7$$

The base number is all the same so the terms can be simplified

$$a^m \times a^n = a^{m+n}$$

$$3^5 \div 3^2 \rightarrow 3^3$$

$$\frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3} \rightarrow \frac{3^3}{3^0} \rightarrow 3^3$$

Subtraction law for indices

$$a^m \div a^n = a^{m-n}$$

Zero and negative indices

$$x^0 = 1$$

$$\frac{a^6}{a^6} = a^6 \div a^6 = a^{6-6} = a^0 = 1$$

Negative indices do not indicate negative solutions

$$2^2 = 4$$

$$2^1 = 2$$

$$2^0 = 1$$

$$2^{-1} = \frac{1}{2}$$

$$2^{-2} = \frac{1}{4}$$

Looking at the sequence can help to understand negative powers

Powers of powers

$$(x^a)^b = x^{ab}$$

$$(2^3)^4 = 2^3 \times 2^3 \times 2^3 \times 2^3$$

The same base and power is repeated Use the addition law for indices

$$(2^3)^4 = 2^{12} \leftarrow a \times b = 3 \times 4 = 12$$

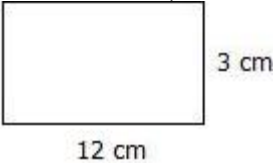
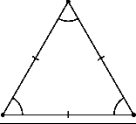
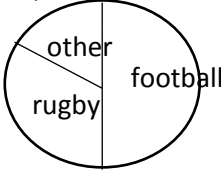
NOTICE the difference

$$(2x^3)^4 = 2x^3 \times 2x^3 \times 2x^3 \times 2x^3$$

The addition law applies ONLY to the powers. The integers still need to be multiplied

$$(2x^3)^4 = 16x^{12}$$

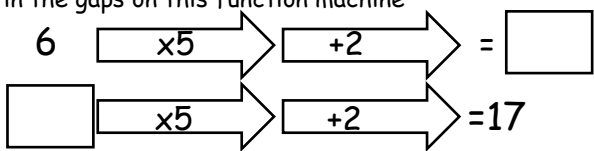
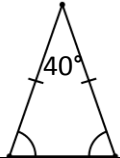

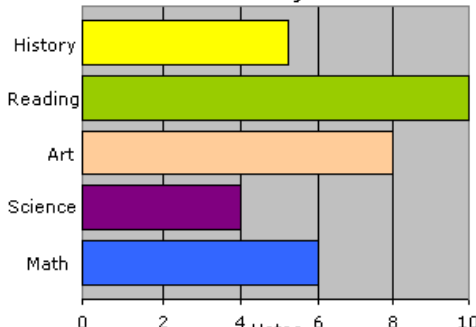
Mixed Topic Homework Sheet 1

1. Calculate $4 \times 7 + 2 =$	2. Fill in the gaps on this function machine <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;">5</div> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 5px;">x3</div> <div style="font-size: 24px; margin: 0 5px;">→</div> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 5px;">+2</div> <div style="font-size: 24px; margin: 0 5px;">→</div> <div style="border: 1px solid black; width: 40px; height: 20px; margin-left: 5px;"></div> </div> <div style="display: flex; align-items: center; justify-content: center; margin-top: 10px;"> <div style="border: 1px solid black; width: 40px; height: 20px; margin-right: 10px;"></div> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 5px;">x3</div> <div style="font-size: 24px; margin: 0 5px;">→</div> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 5px;">+2</div> <div style="font-size: 24px; margin: 0 5px;">→</div> <div style="margin-left: 5px;">= 17</div> </div>
3. Write the following ratio in its simplest form, 4:6	4. What is the perimeter of the following shape? 
5. If I have 20 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
7. List 5 different prime numbers.	8. Write the next three terms of the following sequence: 2, 5, 8, 11, _____, _____, _____
9. If I need 50 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? 
11. Find the median for the following set of numbers: 12, 15, 15, 16, 19, 21, 25	12. If the probability of choosing a strawberry from a bag of strawberries and apples is 0.25, what is the probability of choosing an apple?
13. Write the following decimals from smallest to largest: 0.13, 0.039, 0.31, 0.45, 0.045	14. Simplify $4x + 2y + 3x + 5y$
15. What is the area of the following shape <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">4 cm</div> <div style="border: 1px solid black; width: 180px; height: 60px; position: relative;"> <div style="position: absolute; top: -15px; left: 50%; transform: translateX(-50%);">9 cm</div> </div> </div>	16. Write down all the possibilities when rolling a fair six sided die.
17. What is 50% of 120?	18. Write an expression for the total cost of 4 pencils and 2 rubbers.
19. How many metres are in 3.5km?	20. If the pie chart below represents favourite sports of 40 people, approximately how many chose football? 
Total: /20	Personal Target:

Mixed Topic Homework Sheet 2

1. Calculate $2 + 6 \div 3 =$	2. Fill in the gaps on this function machine <div><div>5</div><div><div><div><div>x4</div></div></div><div><div><div>-3</div></div></div></div><div><div><div><div></div></div></div><div><div><div>x4</div></div></div><div><div><div>-3</div></div></div></div><div><div>=</div><div><div></div></div></div><div><div>=</div><div>33</div></div></div>																
3. If the ratio of gold coins to silver coins is 1:4, how many silver coins would I have if I had 3 gold coins?	4. What is the area of the following shape? <div><div>9 cm</div><div><div>4 cm</div><div></div></div></div>																
5. If I have 15 flowers and 5 are red, what is the probability of me not choosing a red flower?	6. What is the median of the following set of numbers? 2, 3, 4, 6, 7, 7, 9																
7. Circle the prime numbers from the list below: 2, 17, 27, 63, 77, 97	8. What is the term to term rule of the following sequence? 23, 18, 13, 8, 3, -2																
9. If I need 40g of flour to make 12 breadsticks, how much flour would I need to make 18 breadsticks?	10. What is the size of the missing angle in the diagram below? <div><div>30°</div><div><div>b</div><div>50°</div></div></div>																
11. Find the range for the following set of numbers: 12, 15, 15, 16, 19, 21, 25	12. Complete the two way table below. What is the probability a person selected at random liked both star wars and titanic? <table><tr><td>ANSWER</td><td>Like "Titanic"</td><td>Dislike "Titanic"</td><td>Totals</td></tr><tr><td>Like "Star Wars"</td><td>70</td><td></td><td></td></tr><tr><td>Dislike "Star Wars"</td><td>50</td><td>50</td><td></td></tr><tr><td>Totals</td><td></td><td></td><td>200</td></tr></table>	ANSWER	Like "Titanic"	Dislike "Titanic"	Totals	Like "Star Wars"	70			Dislike "Star Wars"	50	50		Totals			200
ANSWER	Like "Titanic"	Dislike "Titanic"	Totals														
Like "Star Wars"	70																
Dislike "Star Wars"	50	50															
Totals			200														
13. Write the following fractions in order from smallest to largest: 1/5 1/2 3/10 4/5	14. Simplify $5e + 2f - 3e - 8f$																
15. What is the perimeter of the following shape <div><div><div></div><div>3 cm</div></div><div>12 cm</div></div>	16. Write down all the possibilities when rolling a fair six sided die, and flipping a fair coin.																
17. What is 30% of 120?	18. Write an expression for the total cost of 10 bracelets and 2 watches.																
19. How many millimetres are in 47cm	20. If the pictogram below represents peoples favourite sports, how many chose rugby? <div><div>Sports Played by 3rd Graders</div><table><tr><td>football</td><td><div><div></div><div></div><div></div><div></div><div></div></div></td></tr><tr><td>tennis</td><td><div><div></div><div></div><div></div></div></td></tr><tr><td>rugby</td><td><div><div></div><div></div><div></div><div></div><div></div><div></div></div></td></tr></table><div>Key <div></div> = 10 students</div></div>	football	<div><div></div><div></div><div></div><div></div><div></div></div>	tennis	<div><div></div><div></div><div></div></div>	rugby	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>										
football	<div><div></div><div></div><div></div><div></div><div></div></div>																
tennis	<div><div></div><div></div><div></div></div>																
rugby	<div><div></div><div></div><div></div><div></div><div></div><div></div></div>																
Total: /20	Personal Target:																

Mixed Topic Homework Sheet 3

1. Calculate $15 \div (3 + 2) =$	2. Fill in the gaps on this function machine 
3. Write the following ratio in its simplest form, 15:60	4. If the perimeter of a shape is 40cm, what could the width and length be?
5. If I have 28 pencils and 7 are blue, what is the probability of me choosing a blue pencil?	6. What is the median of the following set of numbers? 17, 19, 26, 29, 32, 33, 40
7. List all the factors of the number 12	8. Write the next three terms of the following sequence: 12, 18, 24, _____, _____, _____
9. If I need 6 bags of cement to make 20kg of concrete, how many bags would I need to make 50kg of concrete.	10. Calculate the size of the missing angles, and state the reasons for your answer. 
11. Find the mean for the following set of numbers: 12, 15, 15, 16, 19, 21, 25	12. If the probability picking a green marble from a bag of green and red marbles is 0.3, what is the probability of choosing a red marble?
13. Write the following decimals from smallest to largest: 0.23 0.32 0.03 0.9 0.07	14. Simplify $2a \times 3 + 4b \times 2$
15. What is the width of the shape below? 	16. If the probability of a pin landing point up is 0.2, how many times would I expect it to land point up if I were to drop the pin 200 times?
17. What is 45% of 280	18. Solve the following equation: $3g + 2 = 14$
19. How many litres is 4280 ml?	20. Based on the bar chart below, how many people said art was their favourite subject? Favorite Subject  0 2 4 6 8 10 votes
Total: /20	Personal Target: