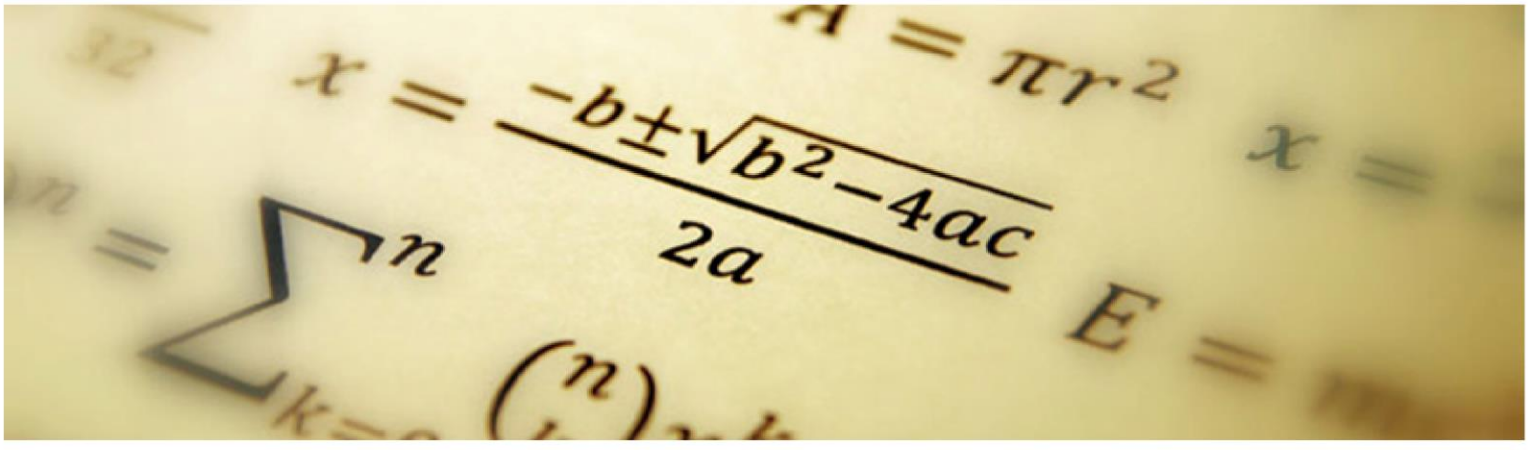
THE DUSTON SCHOOL 4-19

Knowledge Organiser

Maths

Year 10 – Term 2

Additional Maths



Contents of Study

Lesson	Topic
1	What are indices?
2	How can I write in standard form?
3	How can I calculate in standard form?
4	How do I add and subtract with negative numbers?
5	How do I multiply and divide with negative numbers?
6	How do I calculate the area of a quadrilateral?
7	How do I calculate the area of a triangle?
8	How do I calculate the area of a trapezium?
9	How do I calculate the area of a circle?
10	How do I calculate the circumference of a circle?
11	How do I calculate the median, mode and range?
12	How do I calculate the mean even from tables?
13	Application
14	Application
15	Application

Multiplication

+ × + = +

+ × − = −

− × + = −

− × − = +

Division

+ ÷ + = +

+ ÷ − = −

− ÷ + = −

− ÷ − = +

Rules of Indices

Subtraction law for indices

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

$x^0 = 1$

Addition law for indices

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

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

Positive powers of 10

1 billion – 1 000 000 000

$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers > 1

Any number between 1 and less than 10 → $A \times 10^n$ ← Any integer

Example

3.2×10^4

$= 3.2 \times 10 \times 10 \times 10 \times 10$

$= 32000$

Non-example

0.8×10^4

5.3×10^{07}

Negative powers of 10

0.001	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1 \times \frac{1}{1000}$	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
1×10^{-3}	0	0	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

$0.054 = 5.4 \times 10^{-2}$

1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^0	10^{-1}	10^{-2}	10^{-3}
0	0	5	4

A negative power does not mean a negative answer – it means a number closer to 0

Order numbers in standard form

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	1	0.13

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$6.4 \times 10^2 \times 1000$ Not in Standard Form

$= 6.4 \times 10^2 \times 10^3$ Use addition for indices rule

$= 6.4 \times 10^5$

$(2 \times 10^3) \div 4$ Divide the values

$= (2 \div 4) \times 10^3$

$= 0.5 \times 10^3$

$(8) \times 10^5 \times (3)$

$= 24 \times 10^5$ Not in Standard Form

$= 2.4 \times 10^1 \times 10^5$ Use addition for indices rule

$= 2.4 \times 10^6$

Remember the layout for standard form

Any number between 1 and less than 10 → $A \times 10^n$ ← Any integer

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard from at the end

$6 \times 10^5 + 8 \times 10^5$

Method 1

$= 600000 + 800000$

$= 1400000$

$= 1.4 \times 10^5$

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Method 2

$= (6 + 8) \times 10^5$

$= 14 \times 10^5$ ← This is not the final answer

$= 1.4 \times 10^1 \times 10^5$

$= 1.4 \times 10^6$

Only works if the powers are the same

Multiplication and division

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$ ← Division questions can look like this

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$1.5 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

For multiplication and division you can look at the values for A and the powers of 10 as two separate calculations

Revisit addition and subtraction laws for indices – they are needed for the calculations

Addition law for indices: $a^m \times a^n = a^{m+n}$

Subtraction law for indices: $a^m \div a^n = a^{m-n}$

Using a calculator

$14 \times 10^5 \times 3.9 \times 10^3$

Use a calculator to work out this question to a suitable degree of accuracy

Input 14 and press [×10^x] Then press 5 (for the power)

Press [×]

Input 3.9 and press [×10^x] Then press 3 (for the power)

Press [=]

This gives you the solution

Click calculator for video tutorial

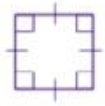
To put into standard form and a suitable degree of accuracy

Press [SHIFT] [SETUP] and then press 7 for sci mode

Choose a degree of accuracy so in most cases press 2

Answer: 5.5×10^8

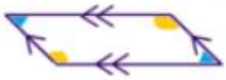
Properties of Quadrilaterals



Square
All sides equal size
All angles 90°
Opposite sides are parallel

Rectangle
All angles 90°
Opposite sides are parallel

Rhombus
All sides equal size
Opposite angles are equal



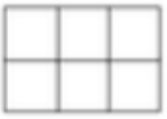
Parallelogram
Opposite sides are parallel
Opposite angles are equal
Co-interior angles

Trapezium
One pair of parallel lines

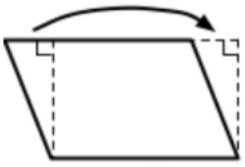
Kite
No parallel lines
Equal lengths on top sides
Equal lengths on bottom sides
One pair of equal angles

Area problems

Rectangle
Base x Perpendicular height



Parallelogram/ Rhombus
Base x Perpendicular height



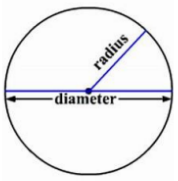
Triangle
½ x Base x Perpendicular height

A triangle is half the size of the rectangle it would fit in

Area of a circle (Non-Calculator)

Read the question – leave in terms of π or if $\pi \approx 3$ (provides an estimate for answers)

Area of a circle
π x radius^2



Diameter = 8cm
∴ Radius = 4cm

π x radius^2
= π x 4^2
= π x 16
= 16π cm^2

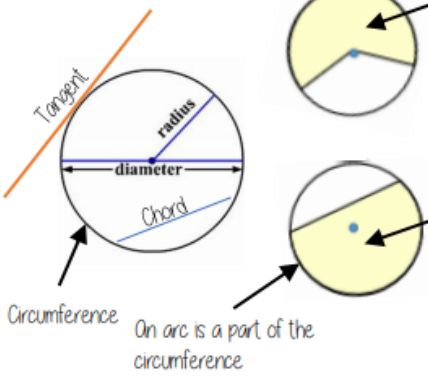
Find the area of one quarter of the circle

Radius = 4cm

Circle Area = 16π cm^2
Quarter = 4π cm^2

Parts of a circle

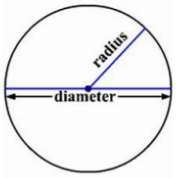
R



Area of a circle (Calculator)

SHIFT ×10^x

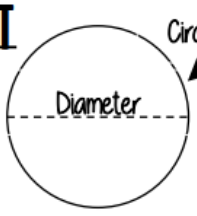
Area of a circle
π x radius^2



How to get π symbol on the calculator

It is important to round your answer suitably – to significant figures or decimal places. This will give you a decimal solution that will go on forever!

Pi π



The ratio of a circles circumference to its diameter

Mean, Median, Mode

The Mean

A measure of average to find the central tendency… a typical value that represents the data

24, 8, 4, 11, 8

Find the sum of the data (add the values) 55

Divide the overall total by how many pieces of data you have 55 ÷ 5

Mean = 11

The Median

The value in the center (in the middle) of the data

24, 8, 4, 11, 8

Put the data in order 4, 8, 8, 11, 24

Find the value in the middle 4, 8, 8, 11, 24

Median = 8

NOTE: If there is no single middle value find the mean of the two numbers left

The Mode (The modal value)

This is the number OR the item that occurs the most (it does not have to be numerical)

24, 8, 4, 11, 8

This can still be easier if it the data is ordered first 4, 8, 8, 11, 24

Mode = 8

Choosing the appropriate average

The average should be a representative of the data set – so it should be compared to the set as a whole - to check if it is an appropriate average

Here are the weekly wages of a small firm

£240	£240	£240	£240	£240
£260	£260	£300	£350	£700

Which average best represents the weekly wage?

The Mean = £307

The Median = £250

The Mode = £240

Put the data back into context

Mean/Median – too high (most of this company earn £240)

Mode is the best average that represents this wage

It is likely that the salaries above £240 are more senior staff members – their salary doesn't represent the average weekly wage of the majority of employers

Averages from a table (R)

Non-grouped data

Number of Siblings	0	1	2
Frequency	6	8	6
Subtotal	0	8	12

Overall Frequency: 20

Total number of siblings: 20

The data in a list: 0,0,0,0,0,0,1,1,1,1,1,1,1,1,2,2,2,2,2,2

Mean: $\frac{\text{total number of siblings}}{\text{Total frequency}} = 1$

Grouped data

x Weight(g)	Frequency
$40 < x \leq 50$	1
$50 < x \leq 60$	3
$60 < x \leq 70$	5

Mid Point	MP x Freq
45	45
65	195
65	325

Overall Frequency: 9

Overall Total : 565

Mean: 62.8g

The data in a list: 45, 55, 55, 55, 65, 65, 65, 65, 65

Comparing distributions

Comparisons should include a statement of average and central tendency, as well as a statement about spread and consistency

Here are the number of runs scored last month by Lucy and James in cricket matches

Lucy: 45, 32, 37, 41, 48, 35

James: 60, 90, 41, 23, 14, 23

Lucy

Mean: 39.6 (1dp), **Median:** 38 **Mode:** no mode, **Range:** 16

James

Mean: 41.8 (1dp), **Median:** 32, **Mode:** 23, **Range:** 76

James has two extreme values that have a big impact on the range

"James is less consistent that Lucy because his scores have a greater range. Lucy performed better on average because her scores have a similar mean and a higher median"

Range

Spread of the values

Difference between the biggest and smallest

3 9 8 12

Range: Biggest value – Smallest value

12 – 3 = 9

Range = 9

Median

The middle value

Example 1

4 3 9 8 12

Median: put the in order 3 4 8 9 12

find the middle number 3 4 (8) 9 12

Example 2

150 154 148

137 160 158

Median: put the in order

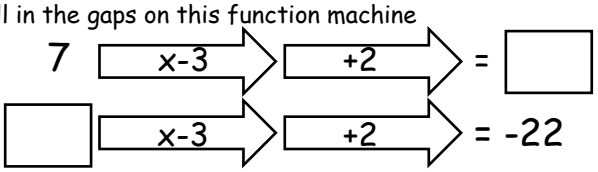
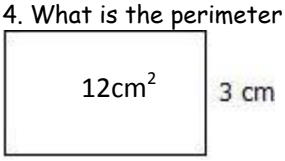
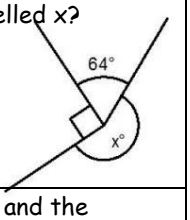
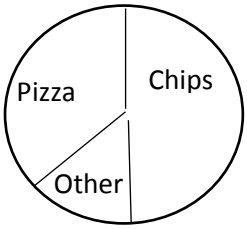
137 148 (150 154) 158 160

There are 2 middle numbers

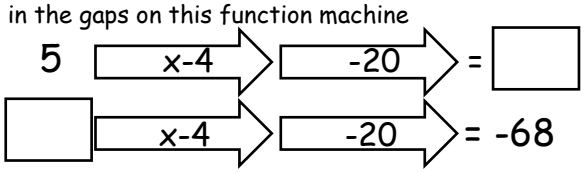
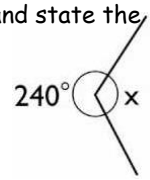
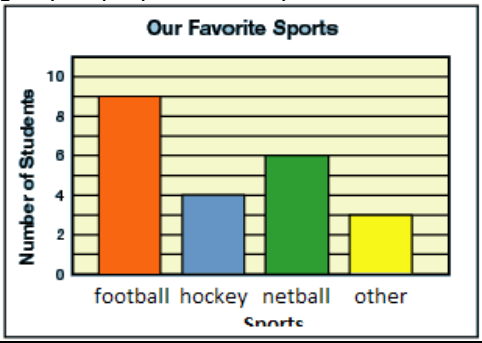
Find the midpoint

152

Mixed Topic Homework Sheet 4

1. Calculate (4 +2) x (3 – 5)	2. Fill in the gaps on this function machine 
3. Write the following ratios in their simplest forms, 5:25 3:33 12:66	4. What is the perimeter of the following shape? 
5. If I have 10 apples, 3 pears and 2 oranges, what it the probability of choosing a pear?	6. What is the mode of the following set of numbers? 4, 5, 8, 5, 2, 6, 4, 5
7. List 3 multiples of 8.	8. What is the nth term rule of the following sequence? 2, 5, 8, 11, 14
9. If a company need 40 potatoes to make 100 packets of crisps, how many potatoes would they need to make 250 packets of crisps?	10. What is the size of the missing angle labelled x? 
11. Find the median for the following set of numbers: 25, 22, 13, 36, 17	12. If the probability winning a game is 0.25, and the probability of drawing is 0.3, what is the probability of losing?
13. Write the following in order from smallest to largest: 0.13, 1/10, 2/5, 0.25, 50%	14. If a = 3 and b = 6, what would 4a + 3b be equivalent to?
15. What is the area of a square with a side length of 9cm.	16. If the probability of the next car I see being red is 0.25, how many of the next 300 cars I see would I expect to be red?
17. Increase 80 by 20%	18. Solve the following equation: 4a – 12 = 88
19. How many centimetres is 52.5 metres?	20. If the pie chart below represents favourite dinners of 300, how many people chose pizza? 
Total: /20	Personal Target:

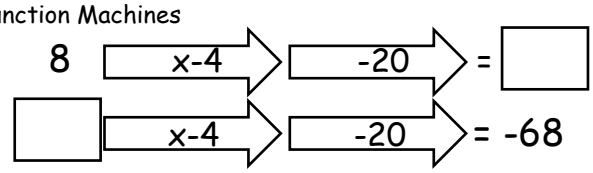
Mixed Topic Homework Sheet 5

1. Calculate 12 – 3 + (4-2) =	2. Fill in the gaps on this function machine 
3. If the ratio of red socks to blue socks is 1:6, how many red socks would I have if I had 24 blue socks?	4. What is the perimeter of a football pitch of length 96m and width of 60m?
5. If I have 45 counters, 20 are red, 5 are green and the rest are blue, what is the probability of not choosing a red counter?	6. What is the mode of the following set of numbers? 64, 58, 64, 72, 55, 64, 55
7. Express 18 as a product of it's prime factors.	8. Write the nth term rule of the following sequence. -2, 5, 12, 19, 26
9. If I need 45g of sugar to make 5 donuts, how much sugar do I need to make 20 donuts?	10. Calculate the size of the angle labelled x, and state the reason for your answer. 
11. Find the median for the following set of numbers: 2, 8, 9, 2, 4, 5	12. If the probability of choosing a strawberry from a bag of strawberries, pears and apples is 0.37, and the probability of choosing a pear is 0.12, what is the probability of choosing an apple?
13. Write the following from smallest to largest: $\frac{3}{4}$ 0.6 2/3 0.7 4/5	14. If x = 6 and y = -3, what is the value of 4x + 2y + 3x + 5y
15. What is the width of a square with an area of 49cm2	16. What is the probability of choosing a red card from a standard pack of cards?
17. Decrease 140 by 15%	18. Solve the following equation: 4(x + 3) = 64
19. How many metres are in 7.86km?	20. If the bar chart below represents favourite sports of a group of people, how many chose football? 
Total: /20	Personal Target:

Mixed Homework Sheet 6

1. 3×4^2

2. Function Machines



3. For every 5 boys on a softball team there is 1 girl. What is the ratio of boys to girls?

4. The perimeter of a rectangle is 232 inches. The width is 36 inches. **What is the length of the rectangle?**

5. What is the probability of choosing a green marble from a jar containing 5 red, 6 green and 4 blue marbles?

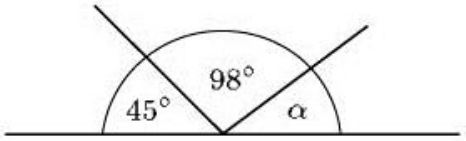
6. Mr Smith kept a record of the number of absences for each student in his class for one term. Here are his results.
0 0 0 8 4 5 5 3 2 1
Write down the mode.

7. Express 210 as a product of it's prime factors.

8. Write the next three terms of the following sequence
12, 8, 4, ___ , ___ , ___

9. If I need 40g of flour to make 20 breadsticks, how much flour would I need to make 140 breadsticks?

10. What is the size of angle a



11. The highest mark in the Science test was 92. Three students scored 46 which was 6 marks higher than the lowest score. What was the range of the scores?

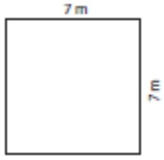
12. If the probability picking a green marble from a bag of green and red marbles is 0.3. If I choose a marble 100 times and replace it each time, how many times would I expect to pick a green marble?

13. Order the following from smallest to largest.

0.31, 0.103, 0.3, 0.1, 0.013

14. Find the value of the following expression if **a** = **2**, **b** = **5** and **c** = **9**.
a + b + c

15. What is the difference between the perimeter and area of the following square?



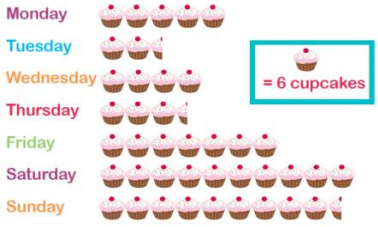
16. You have a pair of dice. Find the probability of rolling a prime number on the first die and an even number on the second.

17. Katie earns £40 per week for her part-time job. She is to be given a 5% pay rise.
How much will she earn per week after the pay rise?

18. Solve the following equation:
$-32 = x + 3$

19. What is 8.5 L in ml?

20. Based on the pictogram below, how many cupcakes were eaten on Sunday?



Total: /20

Personal Target: