THE DUSTON SCHOOL
Knowledge itself is power

Year 10 Maths Higher Knowledge Booklet Term 2

Name:

Class:

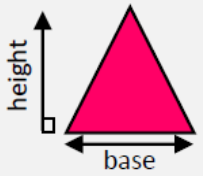
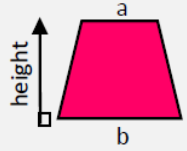
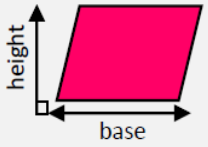
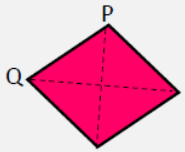
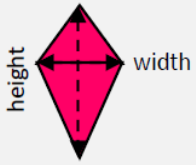
Order	Unit	Links	Pre-requisite skills
1	Integers, powers & roots		
2	Lines, angles & shape		
3	Simplifying & substituting	Unit 1	Using powers, listing factors, understanding product / sum.
4	Area and perimeter	Unit 2	Forming expressions for area/perimeter algebraically through use of brackets, correct notation and simplifying expressions.
5	Calculations & Accuracy	Unit 1	Understanding numbers.
6	FDP	Unit 1	Using powers, understanding lowest common multiples.
7	Sequences, functions and graphs	Unit 3/5	Substituting into a function applying BIDMAS to calculate coordinates, factorising for roots of quadratics, understanding powers and all 4 operations with negatives.
8	Ratio & Proportion	Unit 1/7	Decimals/powers as multipliers, calculating/understanding fractions as parts.
9	Transformations	Unit 2/8	Identifying 90/180/270 degrees, plotting mirror lines of basic functions.
10	Pythagoras and Trigonometry	Unit 1/2/3/4/5	Powers/surds, types of triangles, use in area/perimeter problems to find required lengths, rounding answers.
11	Forming and solving	Unit 3/4	Properties of 2d shapes, angle facts including polygons & parallel lines, algebraic notation and simplifying, forming expressions.
12	Measures	Unit 1/7	Calculating, multiplying decimals and powers of 10 for metric conversions.
13	Volume and Surface area	Unit 4/5/13	Area of 2d shapes, rounding/calculating with bounds, conversion of units (length/area/volume), calculating missing sides using pythagoras/ trigonometry.
14	Probability	Unit 1/7	Types of numbers, calculating with fractions & decimals.
15	Inequalities	Unit 12/8/5/7	Solving equations, rounding, plotting graphs for regions, calculating with fractions.
16	Statistics	Unit 1/6/9/16	Using a protractor for pie charts, proportion to calculate angles for a pie chart, use of inequality symbols for recording data.

Homework 1 Due	
Homework 2 Due	
Homework 3 Due	

Year 10 - Term 2: Higher

Overview	**Learning Objectives**		
Topic: Area and Perimeter **Big Questions** - Show me a sector with a bigger area than a circle. - A square has a perimeter of 49mm. What is its area? - A farmer has 1000m of fencing. What is the largest area he can enclose with it?	- Solve problems involving area and perimeter.	- Calculate the length of an arc and the area of a sector.	
Topic: Calculations and accuracy **Big Questions** - Why might it be useful to know an error interval? - Why is the upper bound of 460 rounded to the nearest 10, not 464?	- Use inequality notation to specify error intervals due to rounding.	- Find the upper and lower bounds of calculations with quantities given to a various degrees of accuracy.	
Topic: Fractions, decimals and percentages **Big Questions** - What is the same/ different about: 120 x 1.06 x 1.06 and 120 x $(1.06)^2$ - A top was reduced by 20% in a sale, then increased by 20% after the sale. What % of it's original price is it now?	- Calculate compound interest/ depreciation -Calculate percentage change. -Work out reverse percentage problems.	- Convert recurring decimals to fractions	-proof of recurring decimals.

AREA & PERIMETER KNOWLEDGE ORGANISER

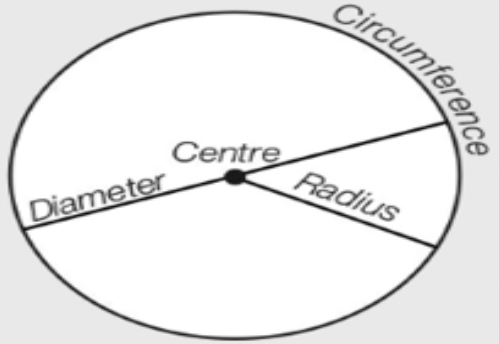
Triangle	$\frac{\text{base x height}}{2}$	
Trapezium	$\frac{(a + b) \text{ x height}}{2}$	
Parallelogram	base x height	
Rhombus	$\frac{P \times Q}{2}$	
Kite	$\frac{\text{width x height}}{2}$	

Circles

Circumference = $\pi \times$ diameter, $C = \pi d$

Circumference = $2 \times \pi \times$ radius, $C = 2\pi r$

Area of a circle = π x radius squared, $A = \pi r^2$



Need-To-Know Facts

The radius of a circle is exactly half the diameter.

π

Pi is the ratio between the circumference of a circle and its diameter always equal to ≈ 3.14

$A = \pi r^2$

Used to calculate the AREA of a circle.

$Sector = \pi r^2 X \frac{\theta}{360}$

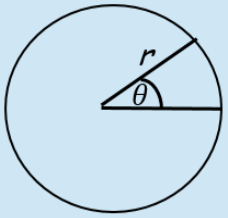
FRACTION of the area (sector)

$C = \pi d$

Used to calculate the CIRCUMFERENCE.

$Arc\ length = \pi d\ x \frac{\theta}{360}$

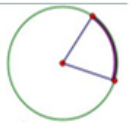
FRACTION of the circumference (arc length)



Area of sector = $\frac{\theta}{360} \times \pi\ r^2$

Arc Length

Arc length is the **distance around** an arc.



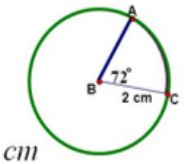
How to find an arc length $\frac{angle}{360} \times 2\pi r$

Example: **Arc Length**

$= \frac{a}{360} 2\pi r$

$= \frac{72}{360} 2\pi 4$

$= 0.8\pi = 2.51\ cm$

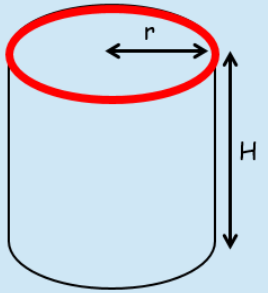


Surface area =

Top = $(\pi \times r^2) +$

Bottom = $(\pi \times r^2) +$

Curved = $(2 \times r \times \pi \times H)$



By adding the area of all of the faces, we can find the **surface area** of the whole cylinder.

Perimeter of an a sector is:

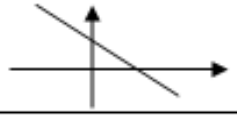
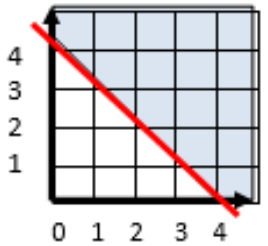
Arc length + 2r

THE DUSTON SCHOOL

Knowledge Recall

Term2 HW: 1

Date Due: _____ **Score to beat:** _____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{5}{9}$ as a recurring decimal		11. Factorise: $x^2 + x - 12$		21. Linear-Quadratic-Cubic-Reciprocal Which function is represented by this graph? 	
2. Write 0.$\dot{1}\dot{7}$ as a fraction		12. Factorise: $x^2 - 100$			
3. Work out the balance for £800 invested for 5 years at 6% per annum		14. Multiply & simplify: $(x - 1)(3x - 2)$		22. What inequality is represented here? 	
4. The value of a house depreciates by 6% per year. Work out the current value of a house bought 3 years ago for £250000.		14. Multiply & simplify: $(4x + 1)^2$			
5. In a '70% off' sale, a dress was £48. Work out the original price.		15. Make a the subject of the formula: $v^2 = u^2 + 2as$		23. On a spinner: P(3) = ½ and the p(4) = ⅙ What is the probability of getting 3 or 4	
6. The cost of a tyre has increased by 20% to £78. Work out the original price.		16. Make e the subject of the formula: $A = de - 2ef$			
7. Write 0.0004 in standard form:		17. $S = \frac{u^2 - v^2}{2a}$ Find S when, u = -4, v = -1.5, a = 2.5		24. A courgette seed and a pumpkin seed is planted. P(courgette seed germinates) = ⅘ P(pumpkin seed germinates) =⅚ What is the probability that BOTH seeds germinate?	
8. Write 7.12×10^3 as an ordinary number		18. $D = ut - kt^2$ Find D when u = 25, t = ⅗, k = -2			
9. Work out $(6 \times 10^7) \div (2 \times 10^3)$ Give your answer in standard form		19. If $\cos 28^0 = \frac{x}{4}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the lower quartile reading 	
10. Work out $(3.7 \times 10^{-4}) \times (2.9 \times 10^{-3})$ Give your answer in standard form		20. Each of these measures is rounded to nearest whole: **a = 5cm and b = 3cm** Calculate the lower bound of a - b			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	

CALCULATIONS AND ACCURACY KNOWLEDGE ORGANISER

DIRECTED NUMBER RULES

+ + = +	+ × + = +	+ ÷ + = +
+ − = −	+ × − = −	+ ÷ − = −
− + = −	− × + = −	− ÷ + = −
− − = −	− × − = +	− ÷ − = +

HALFWAY VALUES—THE DECISION

5 + above ⬆ the number being rounded increases by 1.

4 + below **=** the number being rounded stays the same.

Rounding to...

10, 100 & 1000

Remember to kept the place value of each number by insert zeros where applicable.

Look at the number which **represents the place value**, look to the **right**, if this digit is **5 or more** the number **rounds up by 1**.

If the number is **4 or less** the number **stays the same.**

E.g. Round **17 839** to the nearest 10, 100 & 1000

(i) Nearest 10 – 17 840

(ii) Nearest 100 – 17 800

(iii) Nearest 1000 – 18 000

Decimal places (d.p.)

1. **Identify the position** of the decimal place to be rounded to, e.g. 2d.p. would be the 2nd digit after the decimal place.
2. Then look to the **right** of this digit, this is called the **decider**, this number now decides whether the decimal place is rounded up or kept the same.
3. If the **decider** is **5 or more** then **round the digit up**.
4. If the **decider** is **4 or less** then **leave the digit as it is**.

Significant figures (s.f.)

1. The **first significant number** is the first digit of a number which isn't zero.
2. The **2nd, 3rd, digits** follow immediately after the 1st, regardless of zeros.

0.002309 — SIG. FIGS: 1st 2nd 3rd 4th

2.03070 — 1st 2nd 3rd 4th

(If we're rounding to say, 3 s.f, then the LAST DIGIT is simply the 3rd sig. fig.)

3. When rounding numbers the **place value** of each digit must be the same.

UPPER AND LOWER BOUNDS

- Any recorded measurement has almost certainly been rounded. The true value will be somewhere between the lower bound and the upper bound
- The lower bound is the smallest number that rounds up to the given number. The upper bound is the largest number that rounds down to the given number
- Students should use 'half a unit above' and 'half a unit below' to find upper and lower bounds
  - For discrete data: - data that can only take certain values within a given range
    - e.g. a coach is carrying 50 people, to the nearest 10. The lower bound is 45, and the upper bound is 54
  - For continuous data: - data that can take any value within a given range
    - E.g. The length of a stick of wood is 32 cm, measured to the nearest centimetre. The lower bound is 31.5 cm, and the upper bound is 32.5 cm
      - Due to a mathematical peculiarity the upper bound is 32.5 cm rather than $32.4\dot{9}$ cm
- The lower and upper bounds are sometimes known as the limits of accuracy and the range between them is the error interval
  - E.g. The error interval for the 32 cm stick is as follows; 31.5 cm ≤ length of stick < 32.5 cm
    - Note the use of the strict inequality (<) for the upper bound
- The following table shows the combinations to give minimum and maximum values for all four operations of two numbers, a and b:
  - a and b lie within limits $a_{min} \leq a < a_{max}$ and $b_{min} \leq b < b_{max}$

Operation	Minimum	Maximum
Addition $(a + b)$	$a_{min} + b_{min}$	$a_{max} + b_{max}$
Subtraction $(a - b)$	$a_{min} - b_{max}$	$a_{max} - b_{min}$
Multiplication $(a \times b)$	$a_{min} \times b_{min}$	$a_{max} \times b_{max}$
Division $(a \div b)$	$a_{min} \div b_{max}$	$a_{max} \div b_{min}$

Estimating

When estimating you are **not guessing** you are making the numbers 'easier' for you to work out the sum.

To estimate a sum, you need to

1. Round each number to **1s.f.**
2. Then calculate the sum using **BIDMAS**

Example 1:

Estimate $\frac{29.91 \times 38.3}{3.1 \times 3.9}$

- Round to 1s.f.

$$\frac{30 \times 40}{3 \times 4} = \frac{1200}{12} = 100.$$

Example 2:

Estimate $\frac{23.43 \times 4.3}{0.483}$

- Round to 1s.f.

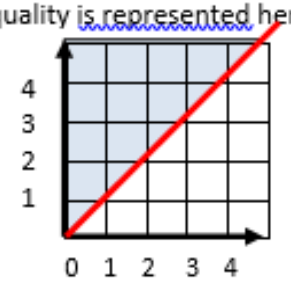
$$\frac{20 \times 4}{0.5} = \frac{80}{0.5} = 160$$

THE DUSTON SCHOOL

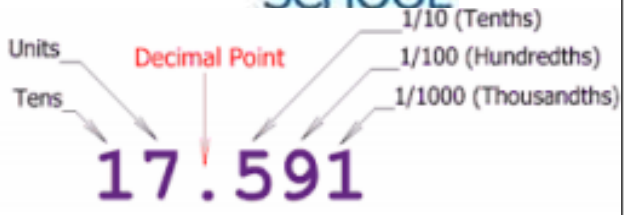
Knowledge Recall

Term2 HW: 2

Date Due: _____ **Score to beat:** _____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{7}{9}$ as a recurring decimal		11. Factorise: $x^2 - 9x - 10$		21. Linear-Quadratic-Cubic-Reciprocal Which function is represented by this graph? 	
2. Write $0.\dot{3}\dot{6}$ as a fraction		12. Factorise: $y^2 - 169$			
3. Work out the balance for £720 invested for 4 years at 5% per annum		14. Multiply & simplify: $(3x - 1)(3x + 1)$		22. What inequality is represented here? 	
4. The value of a house depreciates by 8% per year. Work out the current value of a house bought 2 years ago for £180000.		14. Multiply & simplify: $(2x + 5)^2$			
5. In a '70% off' sale, a hat was £33.60. Work out the original price.		15. Make s the subject of the formula: $v^2 = u^2 + 2as$		23. On a spinner: P(3) = ⅛ and the p(4) = ⅜ What is the probability of getting 3 or 4	
6. The cost of a fridge has increased by 15% to £828. Work out the original price.		16. Make n the subject of the formula: $A = 5mn + pn$			
7. Write 41500 in standard form:		Give your answer correct to 3sf 17. $A = \pi r^2 - \pi rs$ Find A when, r = 6.5 s =2.5		24. A courgette seed and a pumpkin seed is planted. P(courgette seed germinates) = ⅞ P(pumpkin seed germinates) = ½ What is the probability that BOTH seeds germinate?	
8. Write 3×10^{-3} as an ordinary number		Give your answer correct to 3sf 18. $V = \frac{1}{3}\pi h(a^3 - b^3)$ Find V when b = 7 h = 5 & a = 10			
9. Work out $(7 \times 10^3) \times (8 \times 10^2)$ Give your answer in standard form		19. If $\tan 63^0 = \frac{x}{4}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the upper quartile reading 	
10. Work out $(1.69 \times 10^8) \times (5.2 \times 10^3)$ Give your answer in standard form		20. Each of these measures is rounded to nearest whole: **a = 8cm and b = 4cm** Calculate the upper bound of a + b			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	

FRACTIONS, DECIMALS AND PERCENTAGES KNOWLEDGE ORGANISER



What Percentage is this?

If a student received $\frac{28}{50}$ what percentage is this?

Change the denominator to 100 by x2

$$\frac{28 \times 2}{50 \times 2} = \frac{56}{100} = 56\%$$

If a student received $\frac{26}{40}$ what percentage was this?

Change the denominator to 100 by ÷2 and x5

$$\frac{26 \div 2}{40 \div 2} = \frac{13 \times 5}{20 \times 5} = \frac{65}{100} = 65\%$$

Fractions to Decimals

If the fraction has a denominator which is a power of 10, the decimal can be found. You could find an equivalent fraction to create a denominator of 10, 100, 1000 etc.

$\frac{3}{10} = .3$

$\frac{17}{100} = .17$

$\frac{5}{100} = .05$

$\frac{323}{1000} = .323$

$\frac{47}{1000} = .047$

$\frac{9}{1000} = .009$

Key terms

Fraction – written in the form $\frac{a}{b}$, means "a divided by b".

Numerator - the top number of a fraction, represent the number of parts being studied

Denominator – the bottom number of a fraction, represents the number of parts to make one whole

Equivalent – worth the same amount as

Simplify – reducing a fraction to the equivalent with the lowest possible numerator and denominator

Decimal – a number that is not an integer

Integer – a whole number with denominator 1

Percentage – written as a number out of 100

COMPARING & ORDERING DECIMALS

STEP 1: Stack the numbers being compared. Line up the decimal points.

4.8
4.826
4.08
4.006

STEP 2: Add zeros so that each number has the same number of decimal digits.

4.800
4.826
4.080
4.006

STEP 3: Compare each place value one by one. If a number is the same, move to the next place.

4.800
4.826
4.080
4.006

STEP 4: Order the numbers from least to greatest or greatest to least. Here, they are ordered from least to greatest.

4.006, 4.080, 4.800, 4.826

Remove the zeros you previously added.

4.006, 4.08, 4.8, 4.826

$$4\overline{)54} = 13 \text{ r } 2$$

The remainder is 2 out of 4

$^2/_4$ can be written as $^1/_2$ or 0.5

54 ÷ 4 = 13 ½ or 13.5

You can also use the bus stop method of division to find answers as decimals. This represents the fraction

$\frac{2}{7}$ of this circle is shaded.

Example: What is 7.368 – 1.15 ?

Line the decimals up:	7.368 – 1.15
"Pad" with zeros:	1.452 + 1.300
Add:	1.452 + 1.300 2.752

Example: Add 1.452 to 1.3

Line the decimals up:	1.452 + 1.3
"Pad" with zeros:	1.452 + 1.300
Add:	1.452 + 1.300 2.752

To convert decimals to percentages, multiply by 100.

For example, 0.36 = 36%

0.5 = 50%

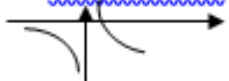
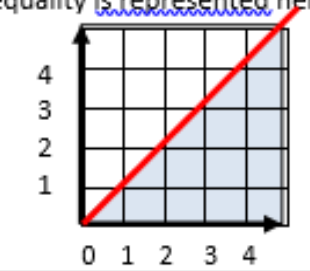
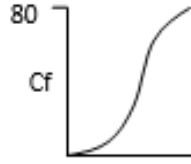
Do the inverse (divide) to convert percentages to decimals

THE DUSTON SCHOOL

Knowledge Recall

Term2 HW: 3

Date Due: _____ **Score to beat:** _____

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{1}{9}$ as a recurring decimal		11. Factorise: $a^2 + 8a - 20$		21. Linear-Quadratic-Cubic-Reciprocal Which function is represented by this graph? 	
2. Write $0.\dot{3}\dot{9}$ as a fraction		12. Factorise: $m^2 - 144$			
3. Work out the balance for £2400 invested for 10 years at 5% per annum		14. Multiply & simplify: $(2a - 3)(2a - 1)$		22. What inequality is represented here? 	
4. The value of a bike depreciates by 35% per year. Work out the current value of a bike bought 2 years ago for £600.		14. Multiply & simplify: $(x + y)^2$			
5. In a '30% off' sale, a hat was £101.50. Work out the original price.		15. Make w the subject of the formula: $P=\frac{3w+20}{200}$		23. On a spinner: P(3) = ½ and the p(4) = ¼ What is the probability of getting 3 or 4	
6. The cost of a fridge has increased by 25% to £525. Work out the original price.		16. Make c the subject of the formula: $ab - cd = ac$			
7. Write 0.000034 in standard form:		Give your answer correct to 3sf 17. $A = \pi r^2 - \pi rs$_ Find A when r = 4.2 s = 3.8		24. A courgette seed and a pumpkin seed is planted. P(courgette seed germinates) =⅗ P(pumpkin seed germinates) = ¼ What is the probability that BOTH seeds germinate?	
8. Write 8.62×10^2 as an ordinary number		Give your answer correct to 3sf 18. $V = \frac{1}{3}\pi h(a^3 - b^3)$ Find V when b = -3 h = 5 & a = 4			
9. Work out $(4.8 \times 10^3) \div (1.2 \times 10^{-2})$ Give your answer in standard form		19. If $\tan 72^0 = \frac{12}{x}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the upper quartile reading 	
10. Work out $(5.2 \times 10^6)^2$ Give your answer in standard form		20. Each of these measures is rounded to nearest whole: **a = 8cm and b = 4cm** Calculate the lower bound of a + b			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	