THE DUSTON SCHOOL
Knowledge itself is power

Year 10 Maths Higher Knowledge Booklet Term 6

Name:

Class:

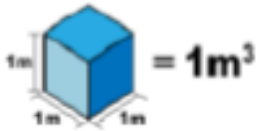
Order	Unit	Links	Pre-requisite skills
1	Integers, powers & roots		
2	Lines, angles & shape		
3	Simplifying & substituting	Unit 1	Using powers, listing factors, understanding product / sum.
4	Area and perimeter	Unit 2	Forming expressions for area/perimeter algebraically through use of brackets, correct notation and simplifying expressions.
5	Calculations & Accuracy	Unit 1	Understanding numbers.
6	Construction and LOCI	Unit 2	Measuring angles for bearings, parallel line angle facts.
7	FDP	Unit 1	Using powers, understanding lowest common multiples.
8	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.
9	Ratio & Proportion	Unit 1/7	Decimals/powers as multipliers, calculating/understanding fractions as parts.
10	Transformations	Unit 2/8	Identifying 90/180/270 degrees, plotting mirror lines of basic functions.
11	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.
12	Forming and solving	Unit 3/4	Properties of 2d shapes, angle facts including polygons & parallel lines, algebraic notation and simplifying, forming expressions.
13	Measures	Unit 1/7	Calculating, multiplying decimals and powers of 10 for metric conversions.
14	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.
15	Probability	Unit 1/7	Types of numbers, calculating with fractions & decimals.
16	Inequalities	Unit 12/8/5/7	Solving equations, rounding, plotting graphs for regions, calculating with fractions.
17	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	

Overview	**Learning Objectives**		
Topic: Volume and Surface Area **Big Questions** A cuboid has a volume of 120cm³. What could its dimensions be? - A prism has a volume of 60m3. It's length is 10m. What is the area of it's cross -section?	-Calculate the volume of a cube or cuboid - Calculate the surface area of a cube or cuboid. - Calculate the volume of triangular prims - Calculate the surface area of triangular prisms - Calculate the height of a cuboid, given volume, width and depth.	- Calculate the volume of cylinders - Calculate the surface area of cylinders.	
Topic: Probability **Big Questions** - What is the difference between probability and relative frequency? - Give an example of an independent or dependent event .	- Understand relative frequency as an estimate of probability. - Use relative frequency to compare outcomes of experiments. - Venn diagrams introduction (2 circles).	- Introduction to the probability notation, eg: U ; n ; P(A); P(A)' - Draw tree diagrams and use them to find probabilities of successive independent events. - Sampling populations.	
Topic: Statistics **Big Questions** - True/Never/Sometimes: - For a set of numbers, the mean is one of the numbers in the set. - For a set of numbers, the mode is one of the numbers in the set. - For a set of numbers, the median is one of the numbers in the set. - For a set of numbers, the range is one of the numbers in the set.	- Compare the averages of two distributions. - Draw and interpret a scatter graph. - Draw and interpret a stem and leaf. - Draw and interpret pie charts.	- Calculate the mode from a table. -Calculate the range from a table. - Calculate the mean from a table with ungrouped data. -Calculate the mean from a table. With grouped data. - Calculate the median from a table.	- Know the definitions of sampling methods. - Sampling populations.

VOLUME AND SURFACE AREA KNOWLEDGE ORGANIS-

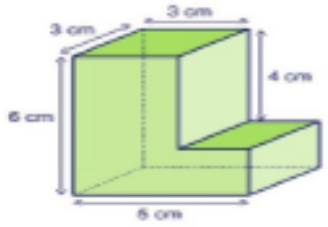
Volume is the measure of the amount of space inside of a solid figure, like a cube, ball, cylinder or pyramid. It's units are always "cubic", that is, the number of little element cubes that fit inside the figure.



A prism is a shape which has a uniform cross-section. The volume of a prism is the area of the cross-section x the length. Below are examples of prisms.

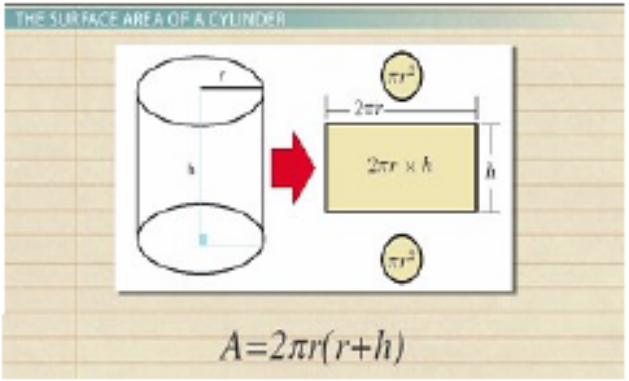
Surface area of a prism

What is the surface area of this L-shaped prism?



To find the surface area of this shape we need to add together the area of the two L-shapes and the area of the 6 rectangles that make up the surface of the shape.

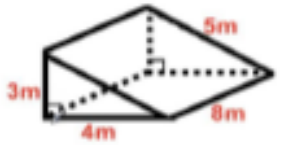
Total surface area
= 2 × 22 + 18 + 9 + 12 + 6 + 6 + 15
= 110 cm²

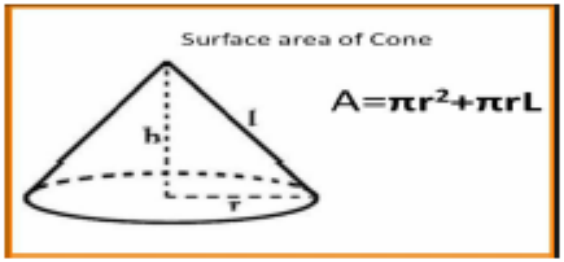


Surface Area of a Triangular Prism

Surface Area =
Triangle Area x 2 → $\frac{1}{2} \times 4 \times 3$
+
Rectangle Area 1 (Floor)
+
Rectangle Area 2 (Left Wall)
+
Rectangle Area 3 (Slope)

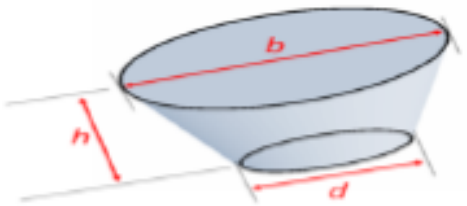
Steps for finding surface area
1. Find the area of each face.
2. Add up all the areas.



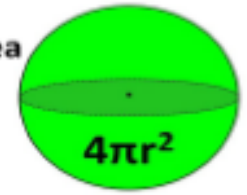


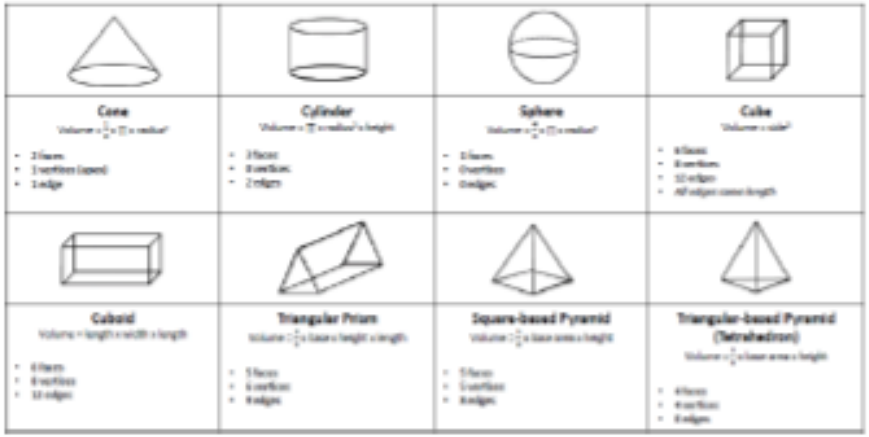
Volume of a Frustum

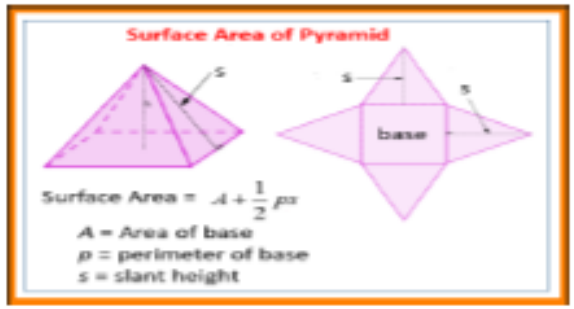
$$V = \frac{\pi h}{12}(d^2 + db + b^2)$$



Surface Area of a Sphere





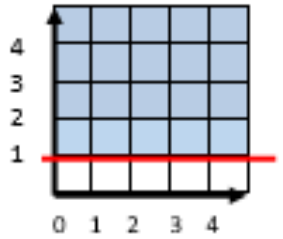


THE DUSTON SCHOOL

Knowledge Recall

Term 6 HW: 1

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{8}{33}$ as a recurring decimal		11. Factorise and solve: $x^2 - x - 12 = 0$		21. Linear-Quadratic-Cubic-Reciprocal Which type of graph is represented by this equation? $y = 3x^3 - 2x^2$	
2. Write $0.1\dot{5}$ as a fraction		12. Factorise: $x^2 - 36y^2$			
3. Work out the balance for £1800 invested for 2 years at 6.4% per annum		14. Multiply & simplify: $(2p - 4)(3p + 1)$		22. What inequality is represented here?  	
4. The value of a boat depreciates by 15% per year. Work out the current value of a boat bought 3 years ago for £10000.		14. Multiply & simplify: $(6a + 2)^2$			
5. In a '70% off' sale, a kettle was £13. Work out the original price.		15. Make n the subject of the formula: $2(m + 3) = \sqrt{n + 5}$		23. P(1st traffic lights are RED) = 0.3 P(2nd traffic lights are RED) = 0.4 What is the probability that both are RED?	
6. A water bill has increased by 25% to £156.25. Work out the original cost.		16. Make z the subject of the formula: $x = \frac{y + 2z}{3}$			
7. Write 72700 in standard form:		17. $d = \sqrt{a^2 + b^2 + 2ab}$ Find d when a = 4 & b = 6		24. Max rolls 2 dice P(the total is 6) = 0.3 P(the total is 8) = 0.13 What is the probability that Max rolls 2 dice and gets totals of 6 or 8?	
8. Write 35.1×10^{-1} as an ordinary number		Give your answer correct to 3sf 18. $d = \sqrt{a^2 + b^2 + c^2}$ Find d when a = -2 b = -3 & c = -4			
9. Work out $(6 \times 10^7) - (4 \times 10^2)$ Give your answer in standard form		19. If $\cos 30^0 = \frac{b}{7}$, find b (3sf)		25. Show on the cumulative frequency graph how to take the median reading  	
10. Work out $(4.35 \times 10^4) + (2.74 \times 10^3)$ Give your answer in standard form		20. These measures are rounded to nearest 10 a = 70cm and b = 50cm 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)	

PROBABILTY KNOWLEDGE ORGAN-

Basic Probability:

- Probability should always be expressed as either a fraction, decimal or percentage less than 1.
- The probability of an event occurring can never be greater than 1.
- The sum of the probabilities of every outcome must = 1.

We use numbers on the probability scale.

0	$\frac{1}{2}$	1
0	0.5	1
0	50%	100%

Impossible — Unlikely — Equally likely — Likely — Certain

We use words on the probability scale.

Important Facts About Probability

Probability **adds up to 1**

Events are **mutually exclusive** when they cannot happen at the same time

Events are **exhaustive** if they include **all** possible outcomes

Calculating Basic Probability:

P(event) = Number of ways the event can occur / Total number of outcomes

$P(rolling\ a\ 6) = \frac{1}{6}$

P(event **not** happening) = 1 - P(event happening).

$P(not\ rolling\ a\ 6) = 1 - \frac{1}{6} = \frac{5}{6}$

Theoretical Probability:

Theoretical Probability is what we expect the probability of an event to be. E.g the theoretical probability of rolling a 1 on a regular 6 sided dice is $\frac{1}{6}$

Experimental probability:

Is when you calculate the probability of an event based on data that has been collected.

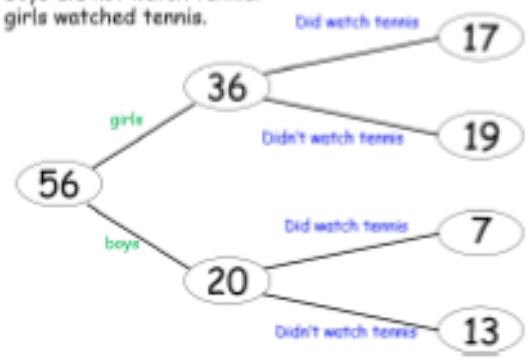
Example: a dice is rolled 60 times. The results are in the table:

Result	1	2	3	4	5	6
No of Result	20	5	12	10	7	6
Experimental Probability	$\frac{20}{60}$	$\frac{5}{60}$	$\frac{12}{60}$	$\frac{10}{60}$	$\frac{7}{60}$	$\frac{6}{60}$

Experimental Probability = number of times result happened / total trials

EXPERIMENTAL PROBABILITY is also known as RELATIVE FRE-

56 students were asked if they watched tennis.
20 of the students are boys.
13 boys did not watch tennis.
17 girls watched tennis.



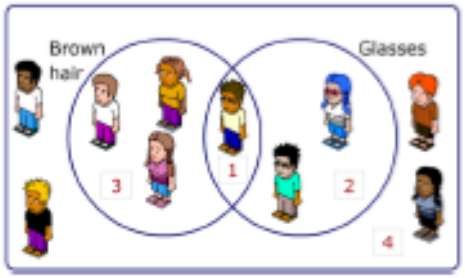
Frequency tree.

- A frequency tree is a pictorial version of a two way table.
- It takes numerical information and summarises it in a chart format.
- Not to be confused with a tree diagram, which on a superficial glance they will be.

Two way tables show data that consider **two different** bits of information.

An example is whether you are a girl or boy (1st bit of info) and whether you have blond, brown, blue, green or black hair (2nd bit of info)

A Venn diagram is used to sort data.



Then n(B) = 4

and n(G) = 3

Also n(B') = 6 (↑ not B)

We write the event that a student has brown eyes and glasses as

B ∩ G

We call this the "intersection".

It's the event that both B and G happen.

1 student lies in B ∩ G

We write the event that a student has brown eyes or glasses as

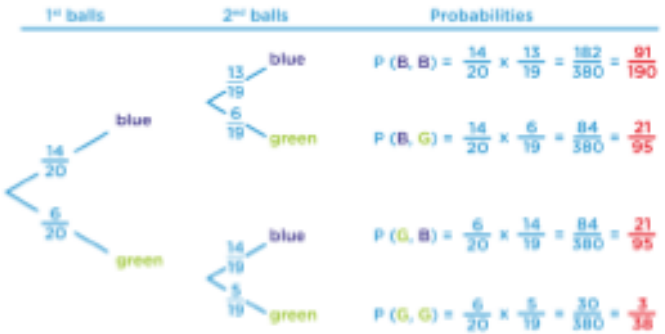
B ∪ G

We call this the "union" of B and G.

It's the event that either B or G happens.

6 students lie in B ∪ G

Probability Tree Diagrams

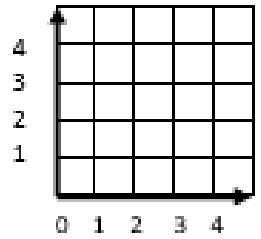


THE DUSTON SCHOOL

Knowledge Recall

Term6 HW: 2

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{24}{99}$ as a recurring decimal		11. Factorise and solve: $2x^2 - 9x - 5 = 0$		21. What is the gradient of a line whose points pass through (0, -3) and (5, 7)	
2. Write $0.\dot{2}\dot{3}\dot{4}$ as a fraction		12. Factorise: $9x^2 - y^2$			
3. Work out the balance for £9400 invested for 4 years at 3.5% per annum		14. Expand & simplify: $(x + 2)(x + 3)(x + 4)$		22. Shade the region that satisfies the inequality $y \leq x + 2$ 	
4. The value of a TV depreciates by 9% per year. Work out the current value of a TV bought 3 years ago for £350.		14. Simplify: $\frac{x^2 - 36}{5x + 30}$			
5. In a '30% off' sale, a table was £120. Work out the original price.		15. Make q the subject of the formula: $P = \frac{q}{7} + 2r$		23. 4 Bakers can decorate 100 cakes in 5 hours. How long would it take 10 bakers to decorate the same number of cakes?	
6. A washing machine has increased by 35% to £472.50. Work out the original cost.		16. Make p the subject of the formula: $q = \frac{p + 1}{p - 1}$			
7. Write 0.0000623 in standard form:		17. Solve the quadratic equation $3x^2 + 7x - 1 = 0$ **Give your answer correct to 2dp**		24. G is inversely proportional to the square root of H. When G =2 and H = 16. Find an equation for G in terms of H.	
8. Write 4.95×10^3 as an ordinary number		18. Complete the square $x^2 - 12x - 5$ and hence solve			
9. What is 146.3 million in standard form?		19. A sector with angle 60° has been cut out of a circle with radius 3 cm. Find the exact area of the shaded shape		25. Show on the cumulative frequency graph how to take the upper quartile 	
10. Work out $(6.75 \times 10^5) \times (2 \times 10^3)$ Give your answer in standard form		20. A rectangle with length 4x and width x cm has an area of 32cm². Find the exact value of x, giving your answer in its simplest form			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	

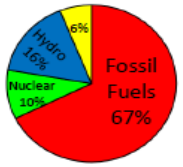
STATISTICS

FOUNDATION

Pie Charts

1.	2.	3.
Draw a circle	Draw a line from the centre	Measure and draw each sector. Label the pie.

Where are these used in Real-Life?



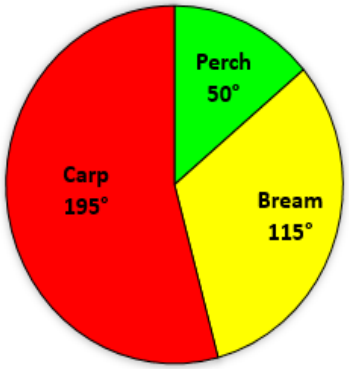
Companies use these to represent data visually in reports to clients.

Easy to see which sector is the biggest.

1	Sum (add up) the frequency
2	360° ÷ frequency 360° ÷ 72 = 5
3	Multiply each category x5 to find sector size

Fish	Frequency	
Perch	10	x 5 = 50°
Bream	23	x 5 = 115°
Carp	39	x 5 = 195°
TOTAL	72	360°
360° ÷ 72 = 5		

Draw an accurate pie chart to show this information.
This table give information about then number of fish in a lake.



Two-Way Tables

What is your favorite sport to watch on television?

	Football	Basketball	Baseball
Males	40	22	15
Females	12	16	45
Total	52	38	60

What is a stem and leaf diagram?

Data is recorded in a table in ascending order.

Stem	Leaves
1	1 1 3 4 5 6 6
2	3
3	3 4 5 6 7
4	4 5

Key: 1|5 means 15

Frequency Polygons

Frequency polygons allow us to display grouped data.

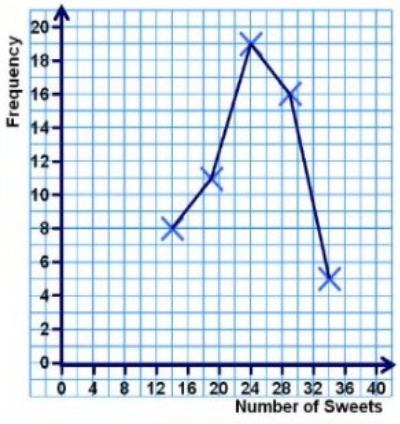
Example 1: A number of boxes of sweets were opened and the contents were counted. Draw a frequency polygon to illustrate this data.

Number of Sweets	Mid Value	Frequency
12 - 16	14	8
17 - 21	19	11
22 - 26	24	19
27 - 31	29	16
32 - 36	34	5

Draw the axes using suitable scales.

Plot each frequency against the mid-value of each range.

Join the points to produce a frequency polygon.



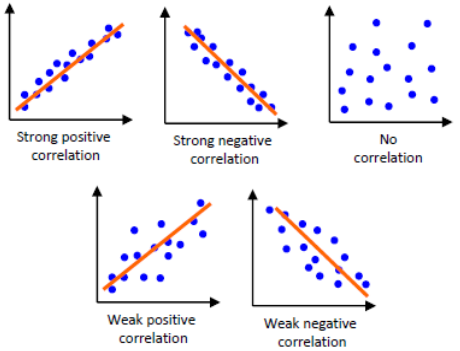
Scatter Graphs

Key Facts - Correlation

Scatter diagrams are used to represent and compare two sets of data.

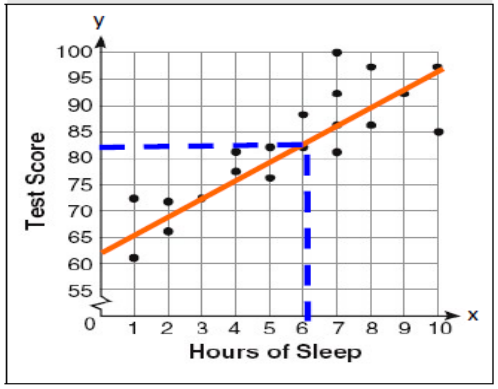
By looking at a scatter diagram, we can see whether there is a relationship between the two sets of data.

Positive	Negative	No correlation
As one variable increases, so does the other	As one variable increases, the other decreases	No relationship



Key Facts – How to Draw a Scatter Diagram

1. Decide on an appropriate scale for the X and Y axis
2. Carefully mark each piece of data on the graph with a dot and label the diagram
3. Draw the line of best fit with an equal number of dots on either side of the line. The line of best fit highlights the trend in the data. It does not have to go through the origin
4. You can read off an estimate using the line of best fit

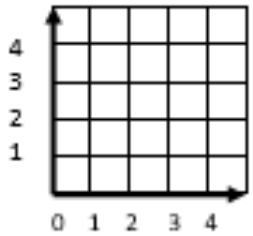


THE DUSTON SCHOOL

Knowledge Recall

Term6 HW: 3

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{5}{33}$ as a recurring decimal		11. Factorise and solve: $3x^2 + 7x - 6 = 0$		21. What is the gradient of a line perpendicular to $y = 3x + 1$	
2. Write $0.\dot{1}\dot{6}$ as a fraction		12. Factorise: $3x^2 - 6x$			
3. Work out the balance for £5700 invested for 6 years at 6.9% per annum		14. Multiply & solve $5x + 4 = 8x - 5$		22. Shade the region that satisfies the inequality $x + y < 4$ 	
4. The value of a speedboat depreciate by 23% per year. Work out the current value of a speedboat bought 2 years ago for £15000.		14. Solve $\frac{x+2}{4} = 4x - 7$			
5. In a '65% off' sale, a vase was £15. Work out the original price.		15. Make u the subject of the formula: $v^2 = u^2 - 2as$		23. A game involves throwing a fair six-sided dice. The player wins if they score either a 5 or a 6. If one person plays the game 180 times, estimate the number of times they will win.	
6. A tax bill has increased by 17% to £210.60. Work out the original cost.		16. Make b the subject of the formula: $a = \frac{5b+3}{4}$			
7. Write 93800 in standard form:		17. Solve the quadratic equation $x^2 + 5x + 3 = 0$ Give your answer correct to 2dp		24. A box contains 5 red discs and 3 green discs. One disc is taken at random and its colour noted before being replaced. A second disc is then taken. Find the probability that both discs are the same colour.	
8. Write 66.2×10^5 as an ordinary number		18. Write $x^2 + 8x + 5$ in the form $a(x+m)^2 + n$			
9. Work out $(5 \times 10^4) + (3 \times 10^8)$ Give your answer in standard form		19. Show that $\cos 30° + \tan 30° = \frac{5\sqrt{3}}{6}$		25. Show on the cumulative frequency graph how to take the lower quartile 	
10. Work out $8^{\frac{4}{3}}$		20. The mass of a cake is given as 2.4 kg rounded to the nearest 0.1 kg Calculate the error interval of the mass (m)			
Total (A)		Total (B)		Total (C)	
Test Total (A+B+C)		R (0-9)	Y (10-19)	G (20-25)	