THE DUSTON SCHOOL
Knowledge itself is power

Year 10 Maths Higher Knowledge Booklet Term 5

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	

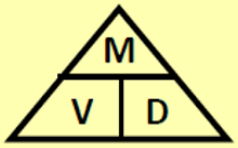
Year 10 - Term 5: Higher

Overview	**Learning Objective**		
Topic: Measures **Big Questions** - What happens to time as speed increases? - What happens to speed as time increases? - What is the difference between speed and acceleration?	- Understand compound measures. - Solve SDT problems. - Solve basic MDV questions. -Convert compound measure problems. E.g 80km/h into mph - Interpret distance time graphs.	- Use compound measures such as speed and density. - Draw and interpret distance-time graphs. - Solve simple speed problems. - Calculate complex average speeds from distance-time graphs.	- Interpret velocity-time graphs. - Calculate distance travelled by calculating the area under a velocity-time graph. - Discuss and interpret graphs modelling real situations
Topic: Volume and Surface Area **Big Questions** - The volume of a cuboid is 120m^3. What could it's dimensions be? - A prism has a cross section of 8cm^2 and a volume of 80cm^3. What is its length?	- Calculate the volume of pyramids. - Calculate the surface area of pyramids - Calculate the volumes of cones - Calculate the surface areas of cones	- Calculate the volume of spheres. - Calculate the surface area of spheres. - Find the volume of the frustum of a truncated cone.	
Topic: Probability **Big Questions** - What is the same/ different about the problems here: - A bag contains 4 blue counters and 5 red counters. Julie picks a counter, replaces it, and then picks again. - A bag contains 4 black counters and 5 pink counters. Sandra picks out two counters - A bag contains 5 blue counters and 4 red counters. Walt picks a counter, replaces it, and then picks again.	- Draw tree diagrams and use them to find probabilities of successive dependent events. (Both with & without replacement)	-Calculate probabilities using Venn diagrams. (3 circles).	-Answer Venn diagrams questions using the notation of 'u' and 'n'

MEASURES KNOWLEDGE ORGANISER

Key Facts

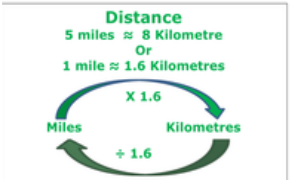
D = Distance; S = Speed T = Time

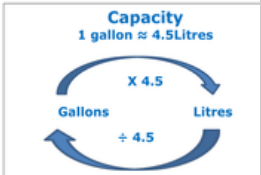


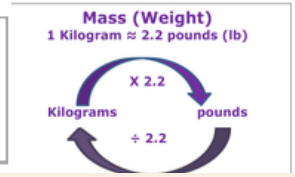
M = Mass; V = Volume; D = Density

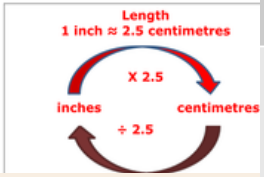
Imperial and Metric Conversions

The ones that you need to memorise are:









How to convert *decimal hours* to HOURS & MINUTES

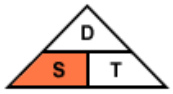
3.1 hours is <u>not</u> 3hrs and 10 minutes!	0.25 hours is <u>not</u> 25 minutes!
Every 0.1 is worth 6 minutes.	It is a quarter of an hour, therefore 15 minutes
0.1 x 60 = 6 minutes	Another way to change the units is to multiply the decimal part by 60
It is a fraction of an hour	So, 0.25 hours is calculated:
So, 3.1 hours is 3 hours 6 minutes	**0.25 x 60 = 15 minutes**

0.1 hour = 6 minutes	0.6 hour = 36 minutes
0.2 hour= 12 minutes	0.7 hour = 42 minutes
0.3 hour = 18 minutes	0.8 hour = 48 minutes
0.4 hour = 24 minutes	0.9 hour = 54 minutes
0.5 hour = 30 minutes	0.25 hour = 15 minutes

Question

Find the speed of a train which travels 243km in 2hrs 15mins.

Answer



Speed = Distance/Time

(Time = 2hrs 15mins)

(15mins = 0.25hr)

$$\textbf{Speed} = \frac{243}{2.25}$$

Speed = 108km/h

The train is travelling at 108km/h.

Distance-time graphs

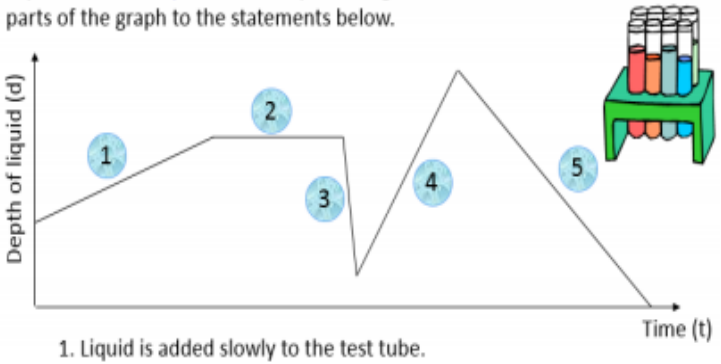
Distance time graphs show distance away from a point. When an object is stationary, the line on the graph is horizontal. When an object is moving at a steady speed, the line on the graph is straight, but sloped. The **steeper** the line, the greater the **speed** of the object.

Other real life graphs

Graphs can be used to represent a number of real life situations. It is important to read the labels on both axes to determine the meaning of the graph.

Example:

A test tube containing a chemical liquid is used in an experiment. During the experiment the depth d of the liquid changes with time t. Match the different parts of the graph to the statements below.



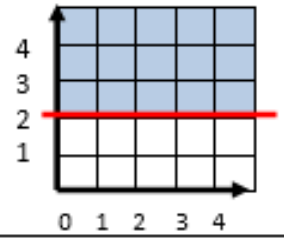
1. Liquid is added slowly to the test tube.
2. The level of the liquid remains constant.
3. Some liquid is poured out quickly.
4. Some liquid is poured in quite quickly
5. The test tube is emptied.

THE DUSTON SCHOOL

Knowledge Recall

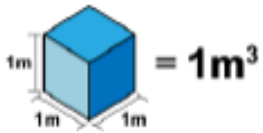
Term5 HW: 1

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{13}{15}$ as a recurring decimal		11. Factorise: $x^2 + 14x + 24$		21. Linear-Quadratic-Cubic-Reciprocal Which type of graph is represented by this equation? $y=3x - 2x^2$	
2. Write $0.\dot{1}$ as a fraction		12. Factorise: $25x^2 - y^2$			
3. Work out the balance for £1500 invested for 4 years at 5.4% per annum		14. Multiply & simplify: $(2x - 2)(4x + 3)$		22. What inequality is represented here? 	
4. The value of a caravan depreciates by 12% per year. Work out the current value of a caravan bought 3 years ago for £14000.		14. Multiply & simplify: $(2a + 1)^2$			
5. In a '80% off' sale, an iron was £13. Work out the original price.		15. Make t the subject of the formula: $a = \frac{t}{b} - st$		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 fuel bill has increased by 18% to £147.50. Work out the original cost.		16. Make r the subject of the formula: $A = 4\pi r^2$			
7. Write 85700 in standard form:		17. $d=\sqrt{a^2 + b^2 + 2ab}$ Find d when a = 2 & b = 3		24. Max rolls 2 dice P(the total is 7) = 0.2 P(the total is 5) = 0.11 What is the probability that Max rolls 2 dice and gets totals of 5 or 7?	
8. Write 3.1×10^{-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 $(7 \times 10^6) - (3 \times 10^3)$ Give your answer in standard form		19. If $\tan 18^0 = \frac{12}{x}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the median reading 	
10. Work out $(7.28 \times 10^8) + (3.64 \times 10^6)$ Give your answer in standard form		20. These measures are rounded to nearest 10 a = 60cm 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)	

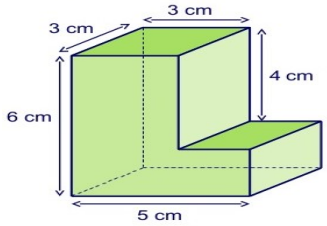
VOLUME AND SURFACE AREA KNOWLEDGE ORGANIS-

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.



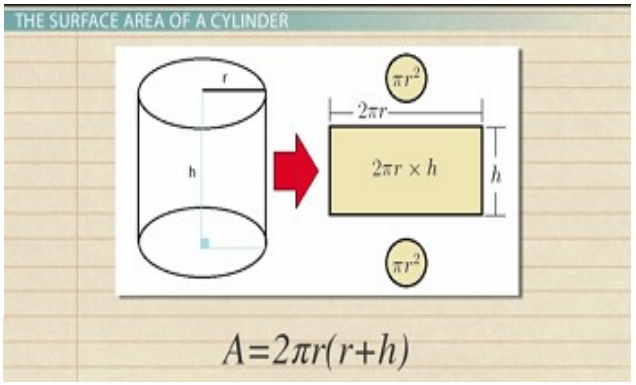
Surface area of a prism

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



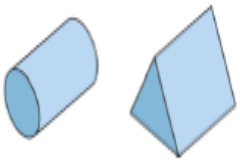
To find the surface area of this shape we need to add together the area of the two L-shapes and the area of the 6 rectangles that make up the surface of the shape.

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



Surface Area of a Triangular Prism

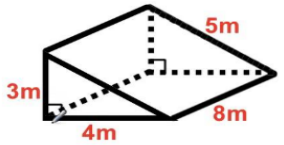
A prism is a shape which has a uniform cross-section. The volume of a prism is the area of the cross-section x the length. Below are examples of prisms.

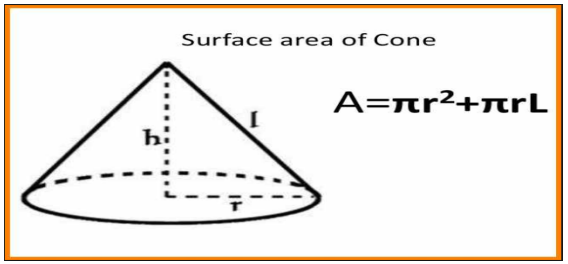


Surface Area =

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

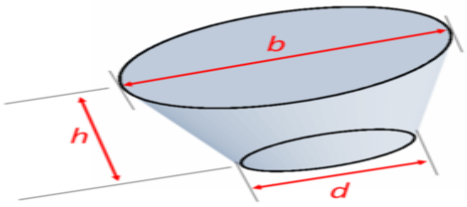
Steps for finding surface area
1. Find the area of each face.
2. Add up all the areas.

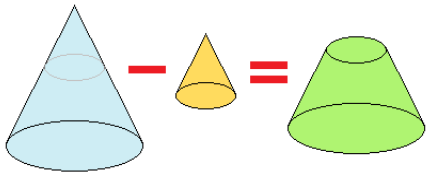




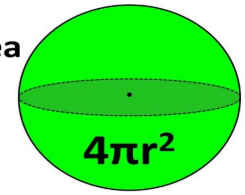
Volume of a Frustum

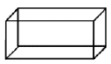
$$V = \frac{\pi h}{12}(d^2 + db + b^2)$$

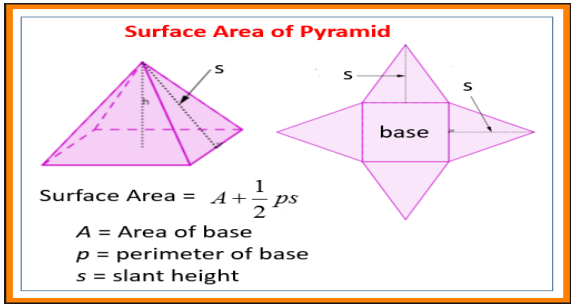




Surface Area of a Sphere



			
Cone Volume = $\frac{1}{3}$ x ∏ x radius² • 2 faces • 1 vertices (apex) • 1 edge	**Cylinder** Volume = ∏ x radius² x height • 3 faces • 0 vertices • 2 edges	**Sphere** Volume = $\frac{4}{3}$ x ∏ x radius³ • 1 faces • 0 vertices • 0 edges	**Cube** Volume = side³ • 6 faces • 8 vertices • 12 edges • *All edges same length*
			
Cuboid Volume = length x width x length • 6 faces • 8 vertices • 12 edges	**Triangular Prism** Volume = $\frac{1}{2}$ x base x height x length • 5 faces • 6 vertices • 9 edges	**Square-based Pyramid** Volume = $\frac{1}{3}$ x base area x height • 5 faces • 5 vertices • 8 edges	**Triangular-based Pyramid (Tetrahedron)** Volume = $\frac{1}{3}$ x base area x height • 4 faces • 4 vertices • 6 edges

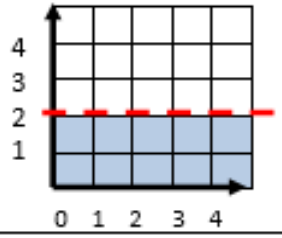


THE DUSTON SCHOOL

Knowledge Recall

Term5 HW: 2

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{4}{15}$ as a recurring decimal		11. Factorise: $x^2 + x - 12$		21. Linear-Quadratic-Cubic-Reciprocal Which type of function is represented by this equation? $y=x^3 - 2x^2$	
2. Write $0.\dot{1}8\dot{9}$ as a fraction		12. Factorise: $x^2 - 9y^2$			
3. Work out the balance for £240 invested for 3 years at 6% per annum		14. Multiply & simplify: $(2x - 3)(2x + 3)$		22. What inequality is represented here? 	
4. The value of a motorbike depreciates by 32% per year. Work out the current value of a motorbike bought 5 years ago for £3600.		14. Multiply & simplify: $(3a - 5)^2$			
5. In a '80% off' sale, an oven was £112. Work out the original price.		15. Make v the subject of the formula: $s = \frac{uv}{u + v}$		23. P(1st traffic lights are RED) = 0.7 P(2nd traffic lights are RED) = 0.3 What is the probability that both are RED?	
6. A water bill has increased by 25% to £52.50. Work out the original cost.		16. Make r the subject of the formula: $v = 4\pi r^2 h$			
7. Write 0.034 in standard form:		17. $d=\sqrt{a^2 + b^2 + 2ab}$ Find d when a = 4 & b = 7		24. Max rolls 2 dice P(the total is 12) = 0.03 P(the total is 10) = 0.08 What is the probability that Max rolls 2 dice and gets totals of 12 or 10?	
8. Write 3.125×10^3 as an ordinary number		Give your answer correct to 3sf 18. $d=\sqrt{a^2 + b^2 + c^2}$ Find d when a = 5.2 b = 3.8 & c = -4			
9. Work out $(6.2 \times 10^5) - (3.7 \times 10^4)$ Give your answer in standard form		19. If $\sin 18^0 = \frac{23}{x}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the lower quartile reading 	
10. Work out $(5.8 \times 10^5) \times (3.5 \times 10^3)$ Give your answer in standard form		20. These measures are rounded to nearest 10 a = 60cm and b = 50cm 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)	

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) = $\frac{\text{Number of ways the event can occur}}{\text{Total number of outcomes}}$

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

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

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

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	$\frac{20}{60}$	$\frac{5}{60}$	$\frac{12}{60}$	$\frac{10}{60}$	$\frac{7}{60}$	$\frac{6}{60}$

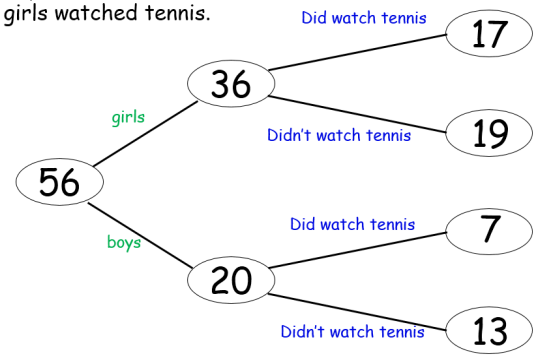
Experimental Probability = number of times result happened / total trials

EXPERIMENTAL PROBABILITY is also known as **RELATIVE FRE-**

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)

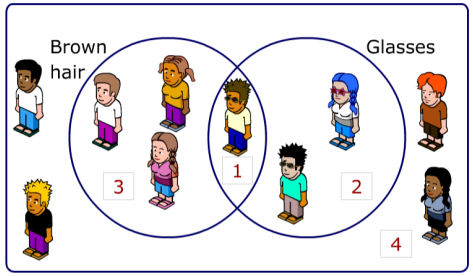
56 students were asked if they watched tennis.
20 of the students are boys.
13 boys did not watch tennis.
17 girls watched tennis.



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.

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 U G

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

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

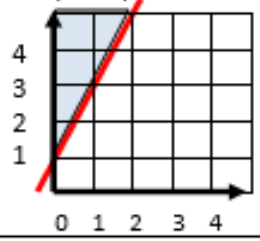
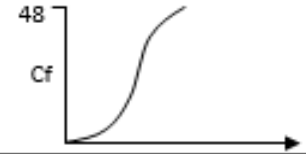
6 students lie in B U G

THE DUSTON SCHOOL

Knowledge Recall

Term5 HW: 3

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

Section A:Number		Section B: Algebra Geometry & measures		Section C: Using and applying	
1. Write $\frac{14}{15}$ as a recurring decimal		11. Factorise: $x^2 - 15x + 36$		21. Linear-Quadratic-Cubic-Reciprocal Which type of function is represented by this equation? $y = \frac{6}{x}$	
2. Write $0.\dot{1}\dot{3}\dot{5}$ as a fraction		12. Factorise: $49x^2 - 25$			
3. Work out the balance for £240 invested for 20 years at 7% per annum		14. Multiply & simplify: $(3x + 1)(3x - 1)$		22. What inequality is represented here? 	
4. The value of a scooter depreciates by 40% per year. Work out the current value of a scooter bought 4 years ago for £600.		14. Multiply & simplify: $(2y + 7)^2$			
5. In a '80% off' sale, a coffee maker was £24.80 work out the original price?		15. Make u the subject of the formula: $s = \frac{uv}{u + v}$		23. P(1st traffic lights are RED) = 0.8 P(2nd traffic lights are RED) = 0.2 What is the probability that both are RED?	
6. A food bill has increased by 24% to £99.20. Work out the original cost.		16. Make r the subject of the formula: $v = \frac{4}{3}\pi r^3$			
7. Write 6700000 in standard form:		17. $d = \sqrt{a^2 + b^2 + 2ab}$ Find d when a = 9 & b = 5		24. Max rolls 2 dice P(the total is 4) = 0.07 P(the total is 10) = 0.1 What is the probability that Max rolls 2 dice and gets totals of 4 or 10?	
8. Write 8.7×10^{-2} as an ordinary number		Give your answer correct to 3sf 18. $d = \sqrt{a^2 + b^2 + c^2}$ Find d when a = 5.4 b = 8 & c = -7			
9. Work out $(4.2 \times 10^9) + (3.6 \times 10^8)$ Give your answer in standard form		19. If $\sin 68^\circ = \frac{x}{16}$, find x (3sf)		25. Show on the cumulative frequency graph how to take the upper quartile reading 	
10. Work out $(5.63 \times 10^5)^2$ to 3sf Give your answer in standard form		20. These measures are rounded to nearest 10 **a = 60cm 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)	