HSC Skills Development: Graphs & Statistics Lorraine Chaffer, President GTANSW

1. CALCULATING RATE of CHANGE (INCREASE OR DECREASE)

You are calculating the speed at which change has occurred (From statistics or a graph)

Rate of change = <u>Change in one variable</u> Change in time (Hours, days, years)

Example: The population increased from 2 million to 3 million people from 2010 to 2015

Rate of change = 1,000,000 people

5 years

 $= \frac{200,000}{1 \text{ year}}$

= rate of 200,000 per year (over 5 years).

In the following example the rate of change is for distance over time*. (speed)



*Source: http://virtualnerd.com/algebra-1/linear-equation-analysis/sloperate-of-change/understanding-slope/rate-of-change-two-points-graph

The faster the rate of change, the steeper the line on a graph.

This is particularly relevant to **Semi Logarithmic** graphs.

TRY THIS



2. CALCULATING PROPORTIONAL or PERCENTAGE CHANGE

You are calculating the amount of change that has occurred ... as a proportion of a starting figure.

Answers could be a %; statement; fraction

- First: Calculate the difference (change) between the two numbers you are comparing Increase = New Number – Original Number.
- 2. Then: divide the increase by the original number and multiply the answer by 100.

Proportional or % change = $\frac{\text{Change}}{\text{Starting figure}}$ X $\frac{100}{1}$

Example: The population increased from 2 million to 3 million people from 2010 to 2015.

Proportional or % change = $\underline{\text{Change 1 million}}$ X $\underline{100}$ Start 2 million 1 = 100 / 2= 50% increase (It increased by half or 50% of the starting figure)

Example: Output from a dairy farm increased from 200, 000 litre to 400,000 litres

Proportional or % change = $\frac{200,000}{200,000}$ X $\frac{100}{1}$

= 100%

(This means it doubled the starting amount of 200,000)

Develop skills questions on proportional increase or decrease when teaching the following topics.

Global challenges eg population and natural resources

Urban places: mega cites and urban dynamics of change

Ecosystems eg. decline in area or biodiversity

Economic activity eg. production and consumption

TRY THIS

A population increases from 500,000 to 1.5 million between 2012 and 2016.

Calculate the percentage change in population.

What does this mean?

 $\frac{\text{Change}}{\text{Starting figure}} = X \frac{100}{1}$

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This means

A population changes from 10.2 million to 50.5 million between 1990 and 2015.

Calculate the proportional change in population. What does this mean?

This means

.....

Who might use this information and for what purpose?

Use the graph to answer the following question.

GLOBAL CAPTURE FISHERIES AND AQUACULTURE PRODUCTION TO 2025



Source: http://www.iffo.net/global-food-security

By what proportion did aquaculture production for humans increase between 1997 and 2017.

Suggested answers. 200% ; 395%; This means the population increased by four times the starting figure; Governments, planners, developers; 196%.

3. INTERPRETING LOG and SEMI-LOGARITHMIC GRAPHS

These graphs are used to graph data which has a large range of values.

- Useful for studying data that changes exponentially eg urban populations
- Can display a larger range of data than an arithmetic scale. Small values occupy a larger proportion of the scale to show change more clearly.
- Useful for showing rate of change. A steep gradient shows a fast rate of change while a shallow gradient represents a slower rate of change.

The spacing between numbers on logarithmic scales is not the same as it would be on an arithmetic scale so care is needed when reading values. A logarithmic scale increases by multiplications in value rather than additions (e.g. 1, 10, 100, 1000 rather than 1, 2, 3, 4).

In the HSC exam, the value by which the scale is multiplied by is usually 10.

Both scales may be logarithmic (2009 HSC) or just one (semi-logarithmic graph).

In these examples, each cycle is 10 times the first

These graphs do not start at 0 Graph A*



- In Graph A the fastest rate of change between 1998 and 2050 will be experienced by..... and the slowest rate of population growth by
- 2. India's population is projected to overtake that of China. What does that tell us about the comparative rate of population change between the two countries?

In Graph B

- 3. What was the population of the west African city in:
 - 1963 2003
- 4. State the 10-year period that experienced the greatest rate of change in population



*Watch this explanation https://www.youtube.com/watch?v=LQc5DaL0WMI * PAST HSC PAPERS – 2003 Q19; 2006 Q17; 2014 Q16-18; 2017 Q20

Graph B*



Source: NESA HSC Examination 2006.

4. CALCULATING DISTANCE, TIME and SPEED

This skill is often linked to other questions eg calculating distance on a topographic map.

The following formulae are used to calculate time and speed of travel as well as distance travelled



Often the distance needs to be calculated by measuring a map distance and then converting this into real-life distances by using the map's scale.

Image: https://www. onlinemath4all.com/ time-speed-and-distanceshortcuts-pdf.html

Example: You are going to travel between two towns. How long will the trip take?

- The map distance between the towns is 5cm
- The scale of the map is 1:100 000
- You drive at 50km/hour

 $Time = \frac{Distance}{Speed} = \frac{5 \text{ km}}{50 \text{ km}} = 1/10 \text{ of } 1 \text{ hour} = 6 \text{ minutes}$

5. PIE GRAPHS

Each segment is a proportion (%) of the value of the circle which represents 100%.

Draw in a clockwise direction, correctly drawn largest to smallest amount.

Use a bearing sheet OR protractor to draw segments or calculate the degrees a sector represents.

Remember

- 100% represents 360 degrees
- 1% represents 3.6 degrees
- 1 degree represents 3.6 %

Country of Birth	Absolute frequency	Relative frequency
Australia	16	32%
Fiji	3	6%
India	8	16%
Italy	10	20%
New Zealand	9	18%
USA	4	8%
Total	50	100%

TRY THIS

1. Time: You travelled 260 kilometres at a speed of 100 kph.

How long did your journey take?

- Speed: It took you 4 hours to travel 320 km between two towns. How fast were you travelling?
- Distance: You travelled at 80 kph for 6 hours. How far did you travel?

Past HSC questions have been multiple choice style and linked to locations on topographic maps. Be prepared to show your calculations.

TIME: 2008 Question 12; 2103 Question 10; 2015 Question 13

SPEED: 2010 Question 5

Distance, Time Speed practice problems – https://cpb-us-e1.wpmucdn.com/share.nanjingschool.com/dist/3/28/files/2013/02/8Sci_FM_ SpeedProbs-1358kwo.pdf

TRY THIS

 Construct a pie graph using the relative frequency information in the table at left.

 Image: Country of Birth % x.6

Country of Birth	% x.6	Degrees
Australia	32%	115.2
	100%	360

Suggested answers: 1.156 minutes/2.6 hours 2.80kph; 480 km

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Pie Graph in order clockwise from North: Italy 72 deg; NZ 64.8 deg; India 57.6 deg; USA 28.8 deg; Fiji 21.6 deg.