## GEOCRAPHICAL SKILLS AND TOOLS

## HSC Skills Development: Graphs \& Statistics

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## 1. CALCULATING RATE of CHANGE (INCREASE OR DECREASE)

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

$$
\text { Rate of change }=\frac{\text { Change in one variable }}{\text { Change in time (Hours, days, years) }}
$$

## Example: The population increased from 2 million

 to 3 million people from 2010 to 2015$$
\begin{aligned}
\text { Rate of change }= & \frac{1,000,000 \text { people }}{5 \text { years }} \\
& =\frac{200,000}{1 \text { year }} \\
= & \text { rate of } 200,000 \text { per year } \\
& \text { (over } 5 \text { years } .
\end{aligned}
$$

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

*Source: http://virtualnerd.com/algebra-1/linear-equation-analysis/slope-rate-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

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

What was the rate of the population increase?
Change $1=$ $\qquad$
Change 2

$$
=
$$

A person travels 800 km . It takes them 4 hours.
What was the rate of change?
Change $1=$ $\qquad$
Change 2

A population changes from 1 million to 600,000 between 1980 and 2010

What was the rate of decrease in the population over that time?

Change $1=$ $\qquad$
Change 2

A winery increases its output from 10,000 bottles in 2015 to to 15,000 bottles in 2018. Calculate the rate of increase.

Change $1=$ $\qquad$
Change 2
$=$
A farmer facing drought reduces his sheep stock from 4,000 to 1,500 over the three months of winter.

Calculate the rate of decrease in sheep stock over that time.

## GEOGRAPHIGAL SKILLS AND IOOLS

## 2. CALCULATING PROPORTIONAL or PERCENTAGE CHANGE

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

Answers could be a \%; statement; fraction

1. 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 $=\frac{\text { Change }}{\text { Starting figure }} \quad \times \quad \frac{100}{1}$

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

Proportional or \% change $=\frac{\text { Change }}{\text { Start }} \frac{1 \text { million }}{2 \text { million }} \times \frac{100}{1}$

$$
\begin{aligned}
& =100 / 2 \\
& =50 \% \text { increase }
\end{aligned}
$$

(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

$$
\begin{aligned}
\text { Proportional or \% change } & =\frac{200,000}{200,000} \times \frac{100}{1} \\
& =100 \%
\end{aligned}
$$

(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?

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

This means
$\qquad$
$\qquad$

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?
$\qquad$
$\qquad$

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.

## AEOCRMPHIGAL SKILLS AND IOOLS

## 3. INTERPRETING LOG and SEMILOGARITHMIC 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*
[2.73] Population 1998 with projections for 2050


1. 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
$\qquad$
5. Calculate the proportional change in population from 2003 to 2015
*Watch this explanation https://www.youtube.com/watch?v=LQc5DaL0WM

* PAST HSC PAPERS - 2003 Q19; 2006 Q17; 2014 Q16-18; 2017 Q20

Graph B*


## GEOGRAPHIGAL SKILLS AND IOOLS

## 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


Distance $=$ Speed $\times$ Time
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-distance-shortcuts-pdf.html

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

- The map distance between the towns is 5 cm
- The scale of the map is 1:100 000
- You drive at $50 \mathrm{~km} /$ hour

Time $=\frac{\text { Distance }}{\text { Speed }}=\frac{5 \mathrm{~km}}{50 \mathrm{~km} / \text { hour }}=1 / 10$ of 1 hour $=6$ 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 <br> Birth | Absolute <br> frequency | Relative <br> frequency |
| :--- | :---: | :---: |
| Australia | 16 | $32 \%$ |
| Fiji | 3 | $6 \%$ |
| India | 8 | $16 \%$ |
| Italy | 10 | $20 \%$ |
| New Zealand | 9 | $18 \%$ |
| USA | 4 | $8 \%$ |
| Total | $\mathbf{5 0}$ | $\mathbf{1 0 0 \%}$ |

## TRY THIS

1. Time: You travelled 260 kilometres at a speed of 100 kph.
How long did your journey take?
2. Speed: It took you 4 hours to travel 320 km between two towns.
How fast were you travelling?
3. 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.


| Country of Birth | \% x.6 | Degrees |
| :---: | :---: | :---: |
| Australia | $32 \%$ | 115.2 |
|  |  |  |
|  |  |  |
|  |  |  |
|  | $\mathbf{1 0 0 \%}$ | $\mathbf{3 6 0}$ |

