Rates

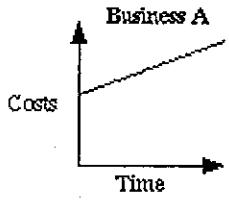
A rate compares two quantities of a different kind.

Rates of Change Rates Gradients of Rates

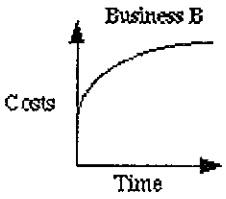
Rates of change

Graphs and tables can be used to show the rates at which chosen variables are changing with time.

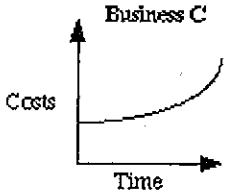
e.g. The following graphs show the costs of running several businesses over the past 6 months.



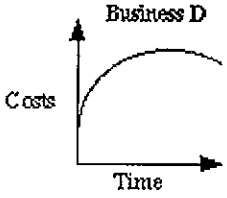
The costs are rising steadily



The costs have been rising but now seem to have levelled out.



The costs are rising at an increasing rate.



The costs are falling after having reached a peak.

As can be seen from these graphs, rates of change can be represented by linear (straight line) graphs or non-linear graphs, such as growth curves.

For Business D the information on the graph could have been shown in a table:

Month	Costs ($ '000)
1	27
2	34
3	40
4	45
5	44
6	41

Rates

A rate compares two quantities of a different kind.

e.g. Speed is a rate which compares distance travelled with time

Speed = kilometre per hour $\left(\frac{\text{km}}{\text{hr}}\right)$

Wage rate = Dollars per week $\left(\frac{\$}{\text{week}}\right)$

Example 1	Answer
A woman earns $425 in 50 hours. What is her hourly rate of pay?	Rate of pay = $\frac{425}{50} = 8.5\frac{\$}{\text{hour}}$
Example 2	**Answer**
A motorist travels 85 km in 2 hours. What is his speed?	Speed = $\frac{85}{2} = 42.5\frac{\text{km}}{\text{hour}}$

Gradients and Rates

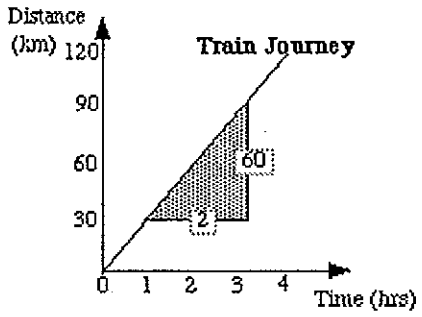
On a straight line graph the gradient is a measure of the rate at which one variable is changing with respect to the other variable. The larger the gradient, the quicker the rate of change.

e.g. The distance travelled by a train going at a constant speed is shown below.

Time (hours)	Distance (km)
0	0
1	30
2	60
3	90
4	120

From the table the speed = 120/4 = 30 km/hr

This data can be shown on a graph:



From the graph, the gradient = the speed = 60/2 = 30 km/hr.

Rates

1. (a) A car travels from north of Sydney to Canberra, a distance of 360 km, in 5 hours. What is its average speed?

(b) The car uses 30 litres of fuel. What was its fuel consumption in km/litre?

2. Express each rate in its simplest form in the units given:

(a) 50 km in 5 hours in km/h

(b) 300 revolutions in 1 hour in revs/min

(c) 20 g per 5 cm^3 in g/cm^3

3. The table shows the level of water in a water tank at different times as it is being drained at a constant rate.

The water is 50 cm deep at the start.

Time (hours)	Level (cm)
0	50
1	40
2	30
3	20
4	10
5	0

(a) Use the table to find the rate at which the water level is falling.

(b) Sketch a graph to show this data, with time along the horizontal axis.

(c) What is the gradient of the line?

4. The table shows the relationship between the area and the radius of a circle.

The formula connecting them is $A = \pi r^2$. (π is given an approximate value of 3 in the table.)

Radius (r)	Area (A)
0	0
1	3
2	
3	
4	

(a) Complete the table.

(b) Sketch a graph to show this data.

(c) Describe in words what is happening to the area of the circle as the radius increases.

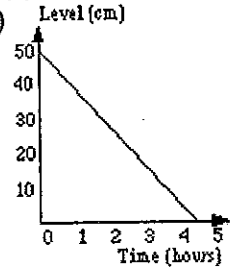
Rates

1. (a) 72 km/hr (b) 12 km/litre

2. (a) 10 km/hr (b) 5 rev/min (c) 4 g/cm^3

3. (a) 10 cm/hr

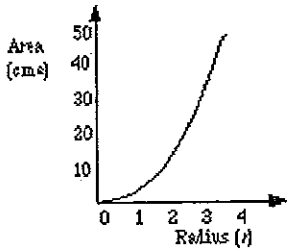
(b)



(c) -10

4. (a) 12, 27, 48

(b)



(c) The area increases more rapidly as the radius increases.

Rates

Unit Test #40

Select your answers to the following 10 questions from the pop-up menus in the right hand column. When you are satisfied with your answers, fill in your name in the space provided below the test, and click the "**Submit Test**" button. Clicking the "Begin Test Again" button will clear all the answers.

Q1:	Eric completed a 5000 metre race in 15 minutes. Eric's average speed in kilometres per hour was	A. 5 B. 15 C. 20 D. $33\frac{1}{3}$	**Answer 1:**	
Q2:	The dosage for my cat's coat conditioner is 1.25 ml per day. About how many months should a bottle containing 150 ml last?	A. 5 B. 4 C. 2 D. 6	**Answer 2:**	
Q3:	A car travels 600 km in 12 hours. What is its average speed for the journey?	A. 200 km/hr B. 60 km/hr C. 50 km/hr D. 20 km/hr	**Answer 3:**	
Q4:	A car travels for 2 hours at 60 k/mh and for 1 hour at 40 km/h. What is its average speed (to the nearest km/hr)?	A. 47 km/hr B. 50 km/hr C. 53 km/hr D. 55 km/hr	**Answer 4:**	
Q5:	Find the cost of 6.5 metres of material at 85 cents/metre.	A. $5.10 B. $5.40 C. $5.53 D. $55.20	**Answer 5:**	
Q6:	How far would a car travel in 5 hours if its average speed was 55 km/hr?	A. 275 km B. 270 km C. 11 km D. 250 km	**Answer 6:**	
Q7:	What is a speed of 90km/hr in km /minute.	A. 3 km/minute B. 1.5 km/minute C. 15 km/minute D. 30 km/minute	**Answer 7:**	
	A car travels for 80 kilometres at 40 k/hr and for	A. 42 km/h	**Answer**	

	a further 80 kilometres at 50 km/hr. What is its average speed (to the nearest km/hr)?	C. 45 km/h D. 80 km/h	**8:**	
Q9:	Which is the fastest? a. 80 km in 1 hour, b. 180 km in 2 hours or c. 250 km in 3 hours.	A. a. B. b. C. c. D. All the same.	**Answer 9:**	
Q10:	An athlete runs 70 metres in 8.4 seconds. If she were to maintain the same average speed for 100 metres her time for 100 metres, in seconds, would be	A. 12.0 B. 11.8 C. 11.4 D. 13.2	**Answer 10:**	

Enter your initial and surname here:

Submit Test | Begin Test Again

8/9 V. Good!

Rates

Unit Test #40

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Q1:	Eric completed a 5000 metre race in 15 minutes. Eric's average speed in kilometres per hour was	A. 5 B. 15 C. 20 D. $33\frac{1}{3}$	**Answer 1:** C	✓
Q2:	The dosage for my cat's coat conditioner is 1.25 ml per day. About how many months should a bottle containing 150 ml last?	A. 5 B. 4 C. 2 D. 6	**Answer 2:** B	✓
Q3:	A car travels 600 km in 12 hours. What is its average speed for the journey?	A. 200 km/hr B. 60 km/hr C. 50 km/hr D. 20 km/hr	**Answer 3:** C	✓
Q4:	A car travels for 2 hours at 60 k/mh and for 1 hour at 40 km/h. What is its average speed (to the nearest km/hr)? 120 km ... 2 hrs; 40 km ... 1 hr; 160 km ... 3 hr; ∴ 53⅓ kph.	A. 47 km/hr B. 50 km/hr C. 53 km/hr D. 55 km/hr	**Answer 4:** C	
Q5:	Find the cost of 6.5 metres of material at 85 cents/metre.	A. $5.10 B. $5.40 C. $5.53 D. $55.20	**Answer 5:** C	✓
Q6:	How far would a car travel in 5 hours if its average speed was 55 km/hr?	A. 275 km B. 270 km C. 11 km D. 250 km	**Answer 6:** A	✓
Q7:	What is a speed of 90km/hr in km /minute.	A. 3 km/minute B. 1.5 km/minute C. 15 km/minute D. 30 km/minute	**Answer 7:**	✓
	A car travels for 80 kilometres at 40 k/hr and for	A. 42 km/h	**Answer**	

	a further 80 kilometres at 50 km/hr. What is its average speed (to the nearest km/hr)?	C. 45 km/h D. 80 km/h	**8:**	
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Q10:	An athlete runs 70 metres in 8.4 seconds. If she were to maintain the same average speed for 100 metres her time for 100 metres, in seconds, would be	A. 12.0 B. 11.8 C. 11.4 D. 13.2	**Answer 10:** A.	✓

Enter your initial and surname here:

Submit Test | Begin Test Again