

Year 10 Advanced Mathematics Topic Test - Rates and Variation

Instructions to Students:

- Answer all questions on the question sheet.
- Calculators may be used.
- Poorly presented work will not be marked.
- Complete the test in pen.

1. Express the following as rates in the units given.

(a) A car travels 240 km in 2 hours 30 minutes (km/h)

(b) A car driver fuelled up with 50 Litres costing \$41.75 (¢ / L)

2. (a) 3 painters can paint a house in 8 days. How many days would 4 painters take?

(b) A tap drips at a rate of 1 millilitre per 3 seconds. How many litres would drip in a day?

3. Convert the following rates:

(a) 72 km/h to km/min

(b) 2.4 kg/min to kg/hour

(c) 4.725 L / 35 km to L / 100 km

(d) 90 km/h to m/sec

4. The amount of money earned at a specialised motorbike bookshop (M) varies directly with the amount sold (B).

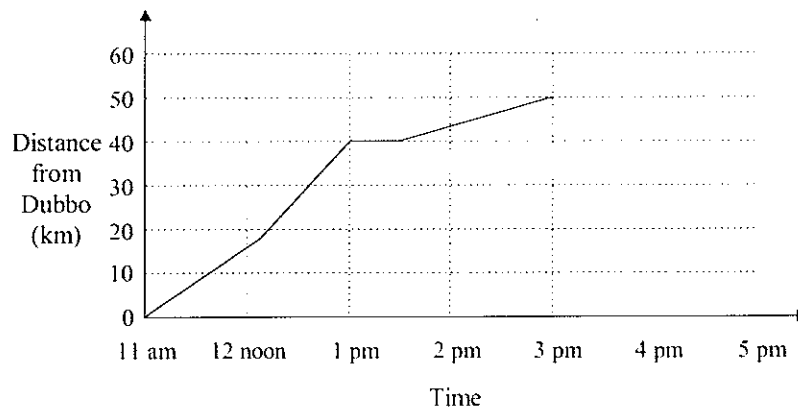
(a) Write a formula connecting M and B using k as the constant of variation.

(b) Find k given $M = \$526.50$ when $B = 39$.

(c) Find the cost of 29 books.

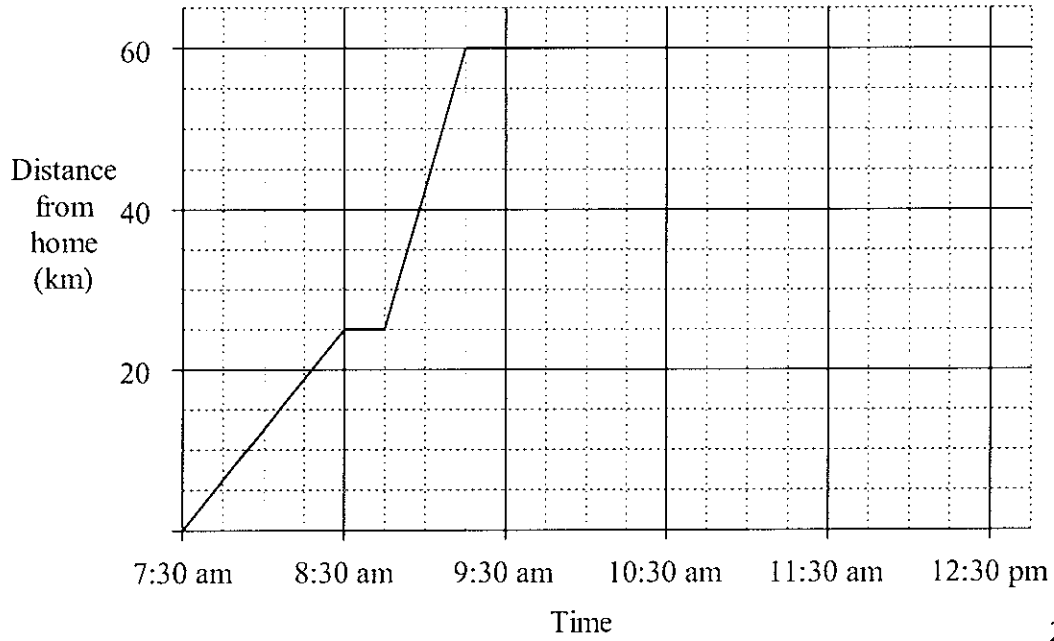
(d) Find the amount of books that need to be sold to earn \$1360.

5. The graph shows a cyclist's distance from Dubbo.



The cyclist stopped at 1 pm for lunch at a park. Later, he continued on his journey. At 3 pm he realized he had left his camera at the park. He took 1 hour to ride back to the park and then decided to go back to Dubbo, which took another hour. Complete the graph to show his ride back.

6.



2

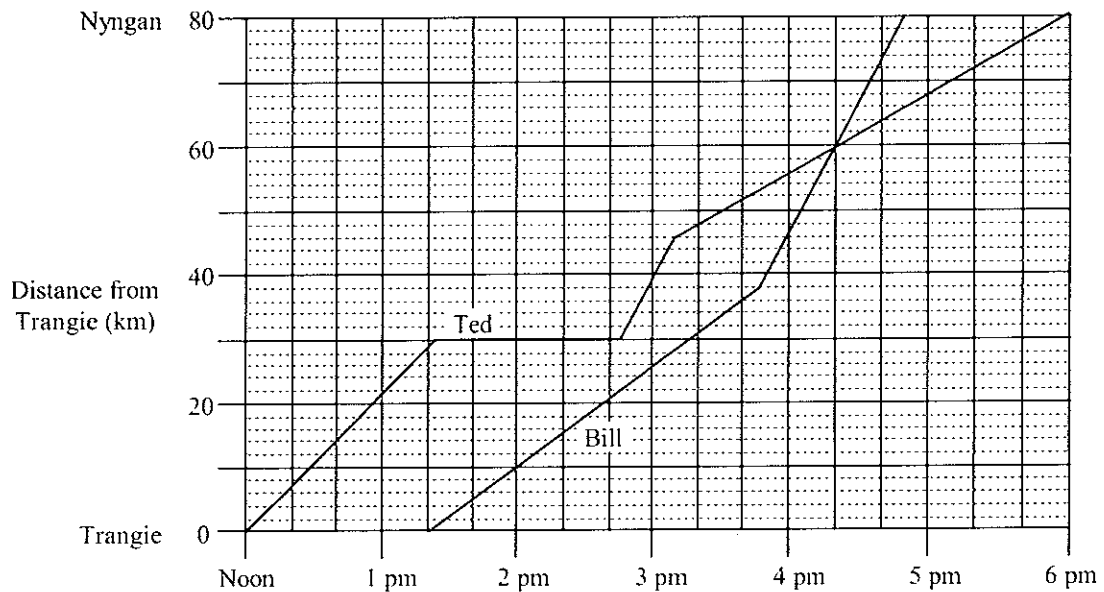
Kim left home at 7:30 am and was driven to a railway station. She waited for the next train and caught it to Parramatta for a meeting. The travel graph shows Kim's distance from home that morning.

(a) At what time did Kim's train leave the station?

(b) What distance did Kim travel by train?

(c) The meeting ended at 10:30 am and Kim caught a taxi home. If the taxi travelled at a constant speed of 40 km/h, complete the graph to show the journey home.

7.



This graph shows the trips taken by Ted and Bill from Trangie to Nyngan.

(a) At what time does Bill leave Trangie?

(b) At what distance from Trangie do Ted and Bill meet?

(c) How far apart are Ted and Bill at 3 p.m.?

(d) What are the fastest speeds of both Bill and Ted during this journey?

8. The stopping distance of a car (s) is proportional to the square of the car's speed (v). A car travelling at 60 km/h has a stopping distance of 40 m. If the stopping distance is 90 m, what is the car's speed?

9. The number of chairs on a ski lift varies inversely with the distance between them. When they are 16 m apart the ski lift can accommodate 45 chairs. If the distance between the chairs is 12 m, how many chairs can be placed on the ski lift?

10. For the direct variation equation $g = kf^3$, what happens to g as f is multiplied by 3?

11. Find the equation of variation for each of these.

(a)

x	0	1	2	3	4
y	0	3	6	9	12

(b)

a	0	4	8	12	16
b	0	-2	-4	-6	-8

(c)

m	0	1	2	3	4
n	0	4	16	36	64

(d)

p	1	2	3	4
q	12	6	4	3

Year 10 Advanced Mathematics Topic Test - Rates and Variation

Instructions to Students:

- Answer all questions on the question sheet.
- Calculators may be used.
- Poorly presented work will not be marked.
- Complete the test in pen.



1. Express the following as rates in the units given.

(a) A car travels 240 km in 2 hours 30 minutes (km/h)

~~240 km / 2.5 h~~
 96 km/h ✓

(b) A car driver fuelled up with 50 Litres costing \$41.75 (\$/L)

$41.75 / 50 = 0.835$ ✓
 83.5¢ / L ✓

2. (a) 3 painters can paint a house in 8 days. How many days would 4 painters take?

$3 \text{ in } 8$ $1 \text{ painter takes } 24 \text{ days}$
 $1 \text{ in } 24 \times 3 = 72$ $4 \text{ painters take } 6 \text{ days}$

(b) A tap drips at a rate of 1 millilitre per 3 seconds. How many litres would drip in a day?

$1 \text{ ml per } 3 \text{ seconds}$
 $86400 \text{ seconds in a day}$
 $\therefore \frac{86400}{3} = 28800 \text{ ml/day}$
 $\therefore 28.8 \text{ L/day}$ ✓

3. Convert the following rates:

(a) 72 km/h to km/min

$72 \text{ km} / 60 \text{ min}$ ✓
 1.2 km/min ✓

(b) 24 kg/min to kg/hour

$24 \text{ kg} \times 60 = 1440$
 $\therefore 144 \text{ kg/h}$ ✓

(c) $4.725 \text{ L} / 35 \text{ km}$ to $\text{L} / 100 \text{ km}$

~~13.511~~

$4.725 \times 100 / 35 = 13.511$
 0.13511 L/km

(d) 90 km/h to m/sec

90000 m/h
 $\therefore 90000 / 3600 = 25 \text{ m/sec}$ ✓

4. The amount of money earned at a specialised motorbike bookshop (M) varies directly with the amount sold (B)

(a) Write a formula connecting M and B using k as the constant of variation.

$M = kB$ ✓

(b) Find k given $M = \$526.50$ when $B = 39$.

$$\$526.50 = k \times 39$$

$$k = 13.5$$

(c) Find the cost of 29 books.

$$M = 13.5 \times 29$$

$$M = \$391.50$$

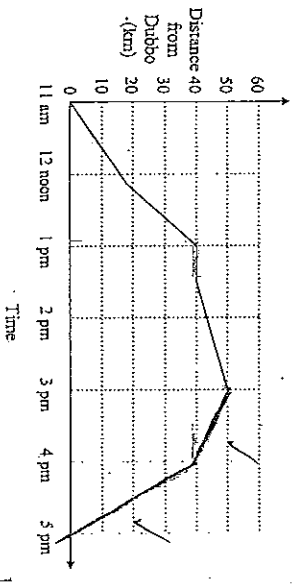
(d) Find the amount of books that need to be sold to earn \$1360.

$$\$1360 = 13.5 \times B$$

$$B = 100.7$$

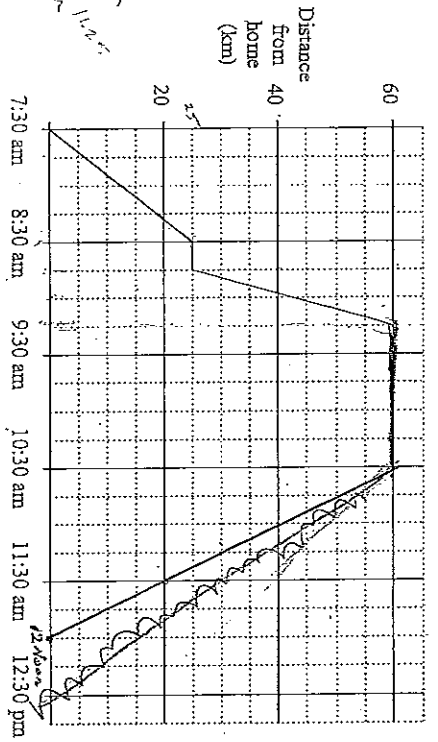
$\therefore 101$ books

5. The graph shows a cyclist's distance from Dubbo.



The cyclist stopped at 1 pm for lunch at a park. Later, he continued on his journey. At 3 pm he realized he had left his camera at the park. He took 1 hour to ride back to the park and then decided to go back to Dubbo, which took another hour. Complete the graph to show his ride back.

6.



Kim left home at 7:30 am and was driven to a railway station. She waited for the next train and caught it to Parramatta for a meeting. The travel graph shows Kim's distance from home that morning.

(a) At what time did Kim's train leave the station?

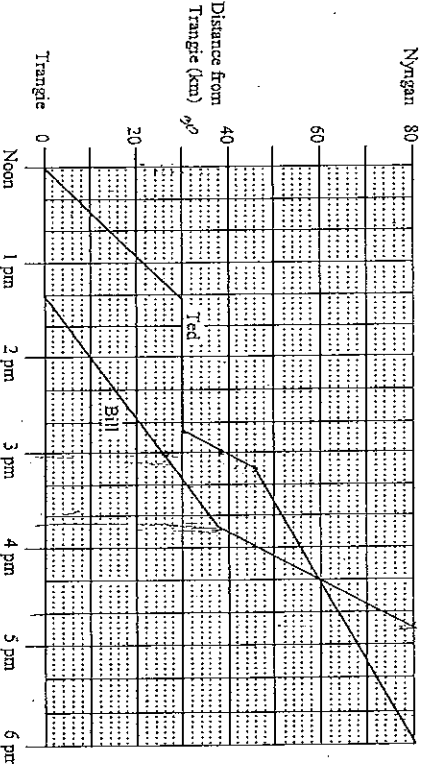
8:45 am

(b) What distance did Kim travel by train?

35 km

(c) The meeting ended at 10:30 am and Kim caught a taxi home. If the taxi travelled at a constant speed of 40 km/h, complete the graph to show the journey home.

60 km in 1.5 h



This graph shows the trips taken by Ted and Bill from Trangie to Nyngan.

Handwritten calculations: $2.50 - 7.10$, 1.2×10 , 2.2 , $2.50 - 1.50$

(a) At what time does Bill leave Trangie?
 1:20 pm ✓

(b) At what distance from Trangie do Ted and Bill meet?
 40 km ✓

(c) How far apart are Ted and Bill at 3 p.m.?
 $38 - 26 = 12 \text{ km}$ ✓

(d) What are the fastest speeds of both Bill and Ted during this journey?
 Ted - $\frac{16}{20 \text{ min}} = \frac{4}{5} \times \frac{60}{60} = 48 \text{ km/h}$ ✓
 Bill - $\frac{40}{40} = 60 \text{ km/h}$ ✓
 Approx. 34.22 km/h

8. The stopping distance of a car (s) is proportional to the square of the car's speed (v). A car travelling at 60 km/h has a stopping distance of 40 m. If the stopping distance is 90 m, what is the car's speed?

$s \propto v^2$
 $40 = 60 \times 3600 \checkmark \quad \therefore 90 = \frac{1}{90} v^2$
 $v^2 = 90 \times 90 \quad 90 \text{ m} = \frac{1}{90} v^2$
 $v = 90 \quad v = \frac{1}{90} v^2$
 $90 \text{ m} = v^2 \quad v = 90$
 $90 \text{ km/h} \checkmark$

9. The number of chairs on a ski lift varies inversely with the distance between them. When they are 16 m apart the ski lift can accommodate 45 chairs. If the distance between the chairs is 12 m, how many chairs can be placed on the ski lift?

$45 = \frac{k}{16} \quad \checkmark \quad y = \frac{720}{12}$
 $\therefore k = 720$
 $\therefore k = 720 = 60 \text{ chairs}$

10. For the direct variation equation $g = kf^3$, what happens to g as f is multiplied by 3?

if $f = 4 (3 \times 4)^3$
 $g = 27k4^3 \checkmark$

11. Find the equation of variation for each of these.

(a)

x	0	1	2	3	4
y	0	3	6	9	12

$y = 3x \checkmark$

(b)

a	0	4	8	12	16
b	0	-2	-4	-6	-8

$y = \frac{ax}{-2} \checkmark$

$b = \frac{a}{-2} \checkmark$

(c)

m	0	1	2	3	4
n	0	4	16	36	64

$n = m^2 \times 4 \quad \checkmark$
 $\therefore n = 4m^2 \checkmark$

(d)

p	1	2	3	4
q	12	6	4	3

$q = \frac{12}{p} \checkmark$

$q = \frac{12}{p} \checkmark$