

High School Mathematics Test 2014

Year 10

Proportion

Calculator Allowed

Skills and Knowledge Assessed:

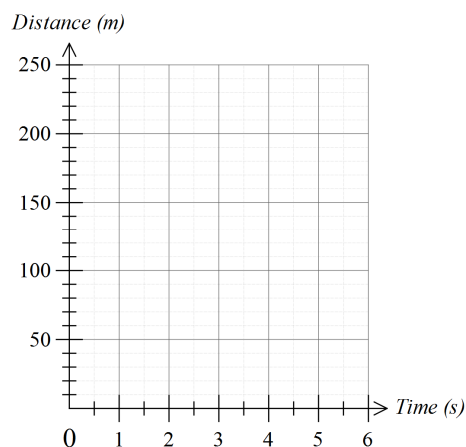
- Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems (ACMNA208)

Name _____

Section 1 Short Answer Section

Write all working and answers in the spaces provided on this test paper.

1. A car travels at a constant speed of 40 m/s for five seconds. Represent this on the distance time graph.



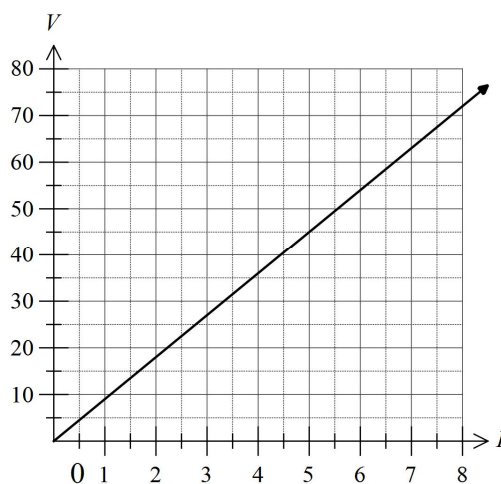
2. The voltage (V) across a wire is given by the equation $V = RI$, where I is the electrical current and R is the resistance in a wire. The graph shows the relationship between V and I for a certain wire.

What is the value of R for this wire?

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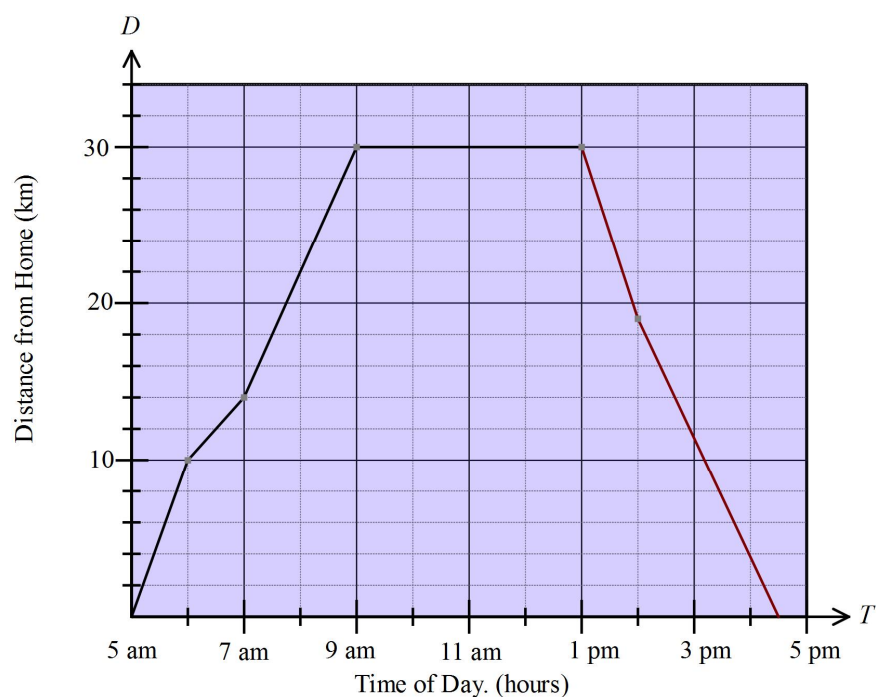
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Questions 3 - 5 refer to the following:

The distance time graph represents Emily's day out, riding her bicycle from her home on a farm into town and back home.



3. How long did she remain in town?

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4. On the way to town, she came upon road-works where she had to ride slowly. When did this occur? (Explain your answer.)

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5. Apart from the road-works, what was the slowest speed at which she cycled, and between what times was this?

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Questions 6 -8 refer to the following:

The amount of fertiliser needed for a paddock (F kg) is directly proportional to the area of the paddock (A m²).

6. Write a proportion equation, using the variable A and F and a constant k .

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7. Given that a paddock with area 20 ha, requires 85 kg of fertiliser, find the value of the constant k .

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8. Calculate the size of the paddock that could be fertilised with 595 kg of fertiliser?

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9. The number of pixels (P) on a TV screen is proportional to the area of the screen (A cm²).

For a particular type of TV, the proportion can be written as $P = 625A$.

How many pixels would there be on a TV with an area of 12 000 cm²?

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10. The light intensity (I candelas) produced by a row of a certain type of light globe is directly proportional to the number of globes (n).

For the equation $I = kn$, the constant of proportion is 4.8.

Find the light intensity produced by 15 globes.

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Questions 11 and 12 refer to the following:

The depth of water (d m) in a cylindrical tank is directly proportional to the time (t minutes) that the water has been pumped into the tank. The depth of water was 42.3 metres after 90 minutes.



11. Write an equation for the proportion linking d and t and find the value of the constant of proportion.

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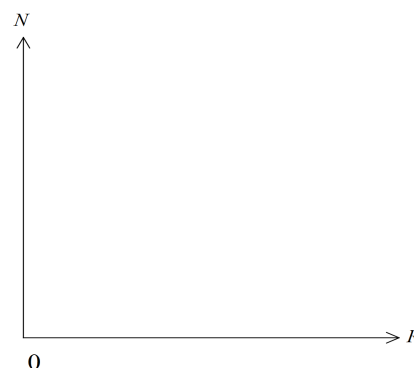
12. Find the time needed for the water to reach a depth of 37.6 m.

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13. The number of bolts needed to attach a circular poster to its support structure is directly proportional to the square of the radius of the poster.

Draw an approximate sketch of this relationship on the axes provided.



14. Describe in words the rate of change of the quantity S relative to T as shown on the graph.

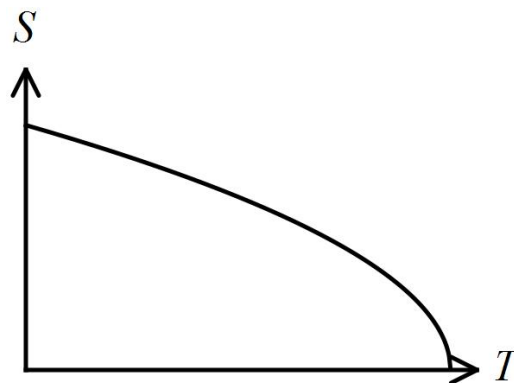
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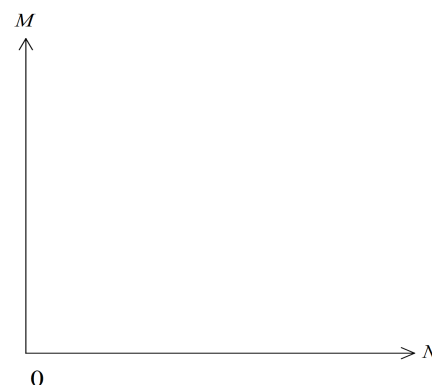
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15. Use the axes provided to draw a sketch of a graph which shows two quantities M and N , where M is increasing at a decreasing rate relative to N .



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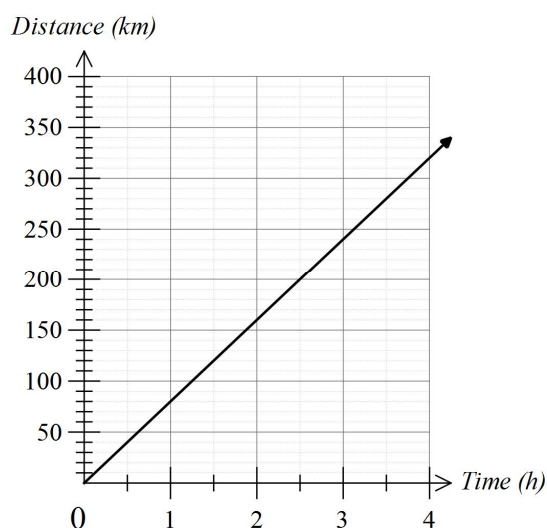
Section 2 Multiple Choice Section

Mark all your answers on the accompanying multiple choice answer sheet, not on this test paper. You may do any working out on this test paper. Calculators are allowed for this section.

1. The distance-time graph represents a car travelling at a constant speed around a test track.

At what speed was the car travelling?

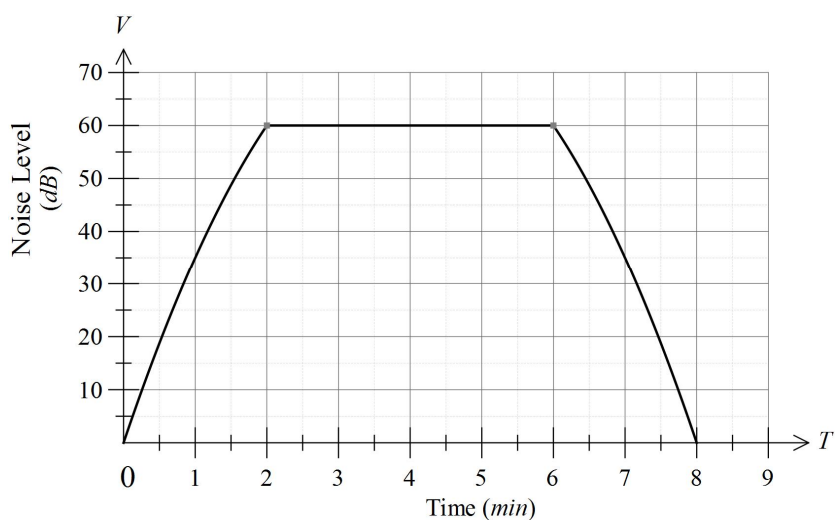
- A. 8 km/h
- B. 24 km/h
- C. 32 km/h
- D. 80 km/h



2. The graph shows the noise level during a piece of music played by a symphony orchestra.

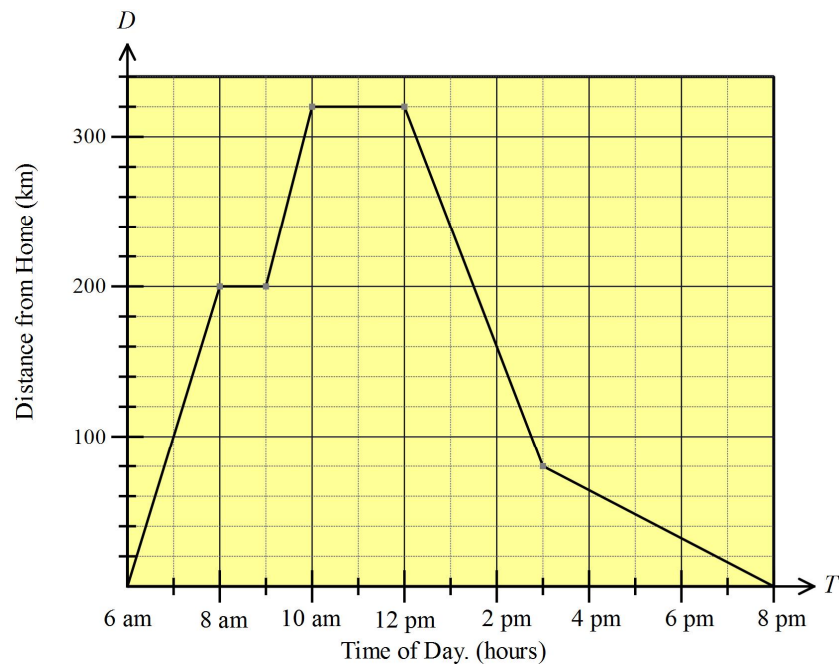
Between what times does the noise level remain constant?

- A. The first two minutes.
- B. The middle four minutes.
- C. The last two minutes.
- D. It doesn't remain constant at any time.



Questions 3 - 5 refer to the following:

The distance time graph shows a sales representative's journey from home to two appointments and back home again.

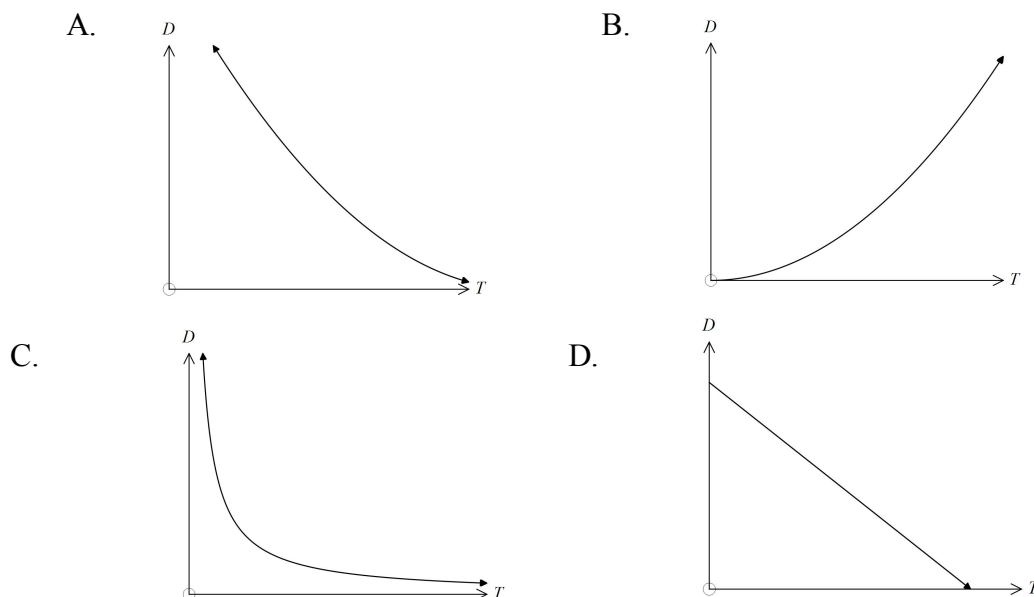


3. When were the appointments?
- A. 6 am to 8 am and 9 am to 10 am. B. 6 am to 8 am and 10 am to 12 pm.
C. 8 am to 9 am and 10 am to 12 pm. D. 12 pm to 3 pm and 3 pm to 8 pm.
4. What was the highest speed that he travelled in either direction?
- A. 80 km/h B. 90 km/h C. 100 km/h D. 120 km/h
5. What speed was he travelling between 3 pm and 8 pm?
- A. 16 km/h
B. 20 km/h
C. 40 km/h
D. 80 km/h
6. The income from a concert (I) is directly proportional to the number of people who attend (N). Each person pays \$70. Which equation describes this proportion?

- A. $N = 70I$ B. $I = 70N$
C. $I = \frac{70}{N}$ D. $N = \frac{70}{I}$

7. Water is emptied out of a reservoir at a constant rate.

If D is the depth of water in the reservoir and T is time, which of these graphs could represent this?



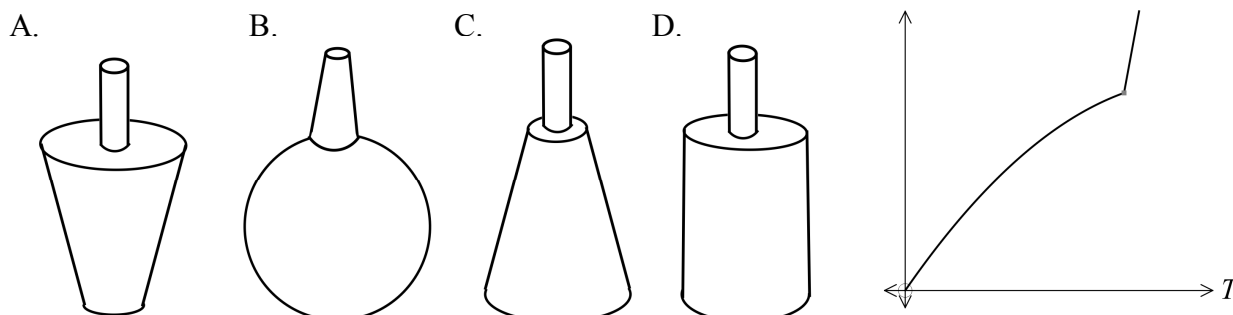
8. Here are two examples of relationships between two quantities.

1. The pay earned by a wage earner increases as the time worked increases.
2. The time taken to complete a job decreases as the number of workers increases.

Which is true?

- A. Both are examples of direct proportion.
- B. Example 1 only is an example of direct proportion.
- C. Example 2 only is an example of direct proportion.
- D. Neither is an example of direct proportion.

9. Water is poured at a constant rate into the bottles below. The depth of water (D) is graphed against time (T). Which bottle might have been filled to produce this graph?



10. A particular direct proportion can be expressed using the equation $U = kY$.
Given that $U = 4$ when $Y = 32$, what is the value of k ?

A. $k = 0.03125$ B. $k = 0.1$ C. $k = 0.125$ D. $k = 8$

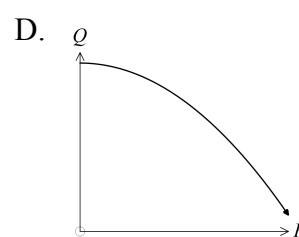
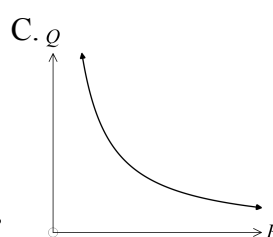
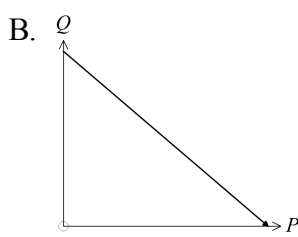
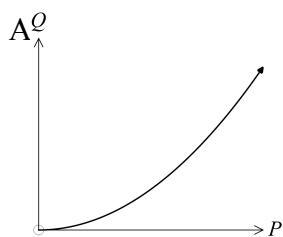
11. The value of a particular coin is directly proportional to its age.
This can be expressed as

$$V = kA.$$

If the value is \$191.25 when the age is 85 years, what is the value of k ?

A. $k = 0.4$ B. $k = 2.25$ C. $k = 37.7$ D. $k = 16256.25$

12. Which graph shows that as P increases at a constant rate, Q is decreasing at a decreasing rate?



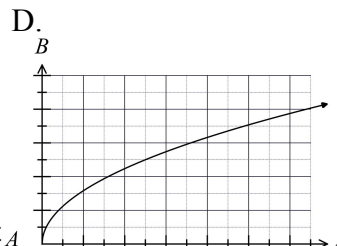
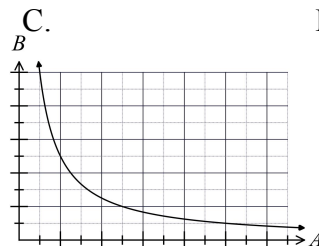
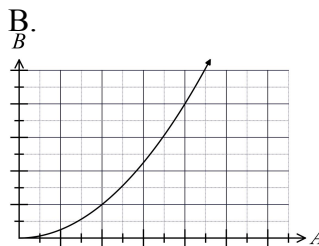
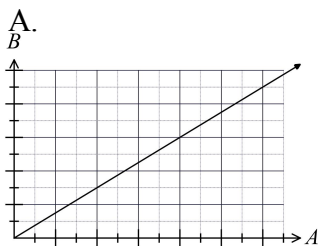
13. The momentum (M) experienced by a certain vehicle is directly proportional to the square of the velocity (V). At a speed of 20 m/s the momentum is 18 m/s². Which equation describes this relationship?

A. $M = 0.045V^2$ B. $M = 0.9V^2$ C. $M = 1.11V^2$ D. $M = 22.22V^2$

14. The amount of paint (P) needed for 1.8 m high wooden fence is directly proportional to the length (L) of the fence. A 12 m long fence needs 10.2 litres of paint. How much paint does a 15 m long fence need?

A. 0.85 litres B. 8.50 litres C. 12.75 litres D. 17.65 litres

15. B is directly proportional to the square root of A . Which graph illustrates this proportion?



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Proportion

Multiple Choice Answer Sheet

Name _____

Completely fill the response oval representing the most correct answer.

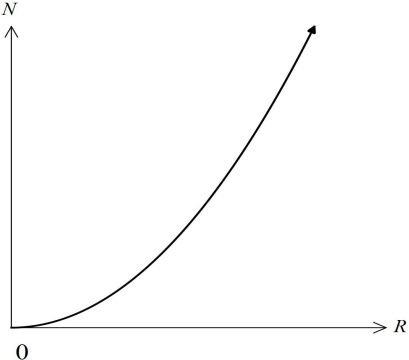
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High School Mathematics Test 2014

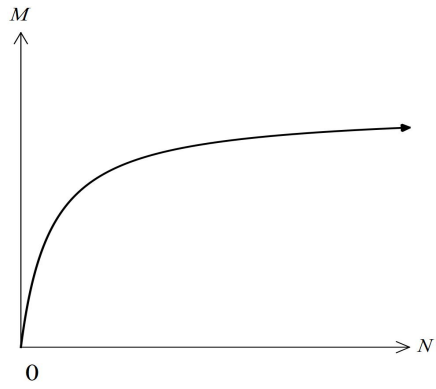
Proportion

ANSWERS

Section 1 (1 mark each)	
	Working and Answers
1.	
2.	<p>Passes through the point (5, 45)</p> $V = RI$ $45 = R \times 5$ $R = \frac{45}{5}$ $R = 9$
3.	Remained in town for 9 am to 1 pm, a total of 4 hours.
4.	The road works was between 6 am and 7 am (the part where the slope of the graph becomes less steep)
5.	<p>Least slope is between 2 pm and 4:30 pm. Distance travelled in this time is 19 km, so</p> $\text{Speed} = \frac{19}{2.5}$ $= 7.6 \text{ km/h}$
6.	$F = kA$ or accept $A = k F$
7.	$F = kA$ $85 = k \times 20$ $k = \frac{85}{20}$ $= 4.25$

8.	$595 = 4.25A$ $A = \frac{595}{4.25}$ $= 140 \text{ ha}$
9.	$P = 625A$ $A = 2.4$ $P = 625 \times 12000$ $= 7\,500\,000 \text{ pixels}$
10.	$I = kn$ $I = 4.8n$ $I = 4.8 \times 15$ $I = 72 \text{ candelas}$
11.	$d = kt$ $42.3 = k \times 90$ $k = \frac{42.3}{90}$ $= 0.47$
12.	$d = 0.47t$ $37.6 = 0.47t$ $t = \frac{37.6}{0.47}$ $t = 80$ It takes 80 minutes
13.	
14.	The quantity S is decreasing at an increasing rate.

15.



Section 2 (1 mark each)		
	Working	Answers
1.	Speed = $\frac{320}{4} = 80$ km/h	D
2.	The middle four minutes, when the graph is horizontal.	B
3.	The appointments are 8 am to 9 am and 10 am to 12 pm when the graph is horizontal	C
4.	Highest speed is between 9 and 10 $s = \frac{120}{1} = 120$ km/h	D
5.	Speed is between 3 and 8 $s = \frac{80}{5} = 16$ km/h	A
6.	I is directly proportional to N $I = kN$ $k = 70$, since each pays \$70 $I = 70N$	B
7.	A constant rate implies a straight line of variation, going downward as it is decreasing.	D
8.	The first is direct proportion, the second is inverse proportion.	B
9.	Rate of rise slows, which indicates the bottle is getting wider, then quickly increases as the neck (narrower) is reached.	A
10.	$U = kY$ $4 = k \times 32$ $k = \frac{4}{32}$ $k = 0.125$	C
11.	$V = kA$ $191.25 = k \times 85$ $k = \frac{191.25}{85}$ $k = 2.25$	B
12.	B, C and D have Q decreasing, but only in C is the rate of decrease slowing (decreasing).	C
13.	$M = kV^2$ $18 = k \times 20^2$ $18 = 400k$ $k = \frac{18}{400}$ $k = 0.045$	A

14.	$P = kL$ $10.2 = k \times 12$ $k = \frac{10.2}{12}$ $k = 0.85$ $P = 0.85L$ $P = 0.85 \times 15$ $= 12.75 \text{ litres}$	C
15.	D depicts $B = k\sqrt{A}$.	D

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Multiple Choice Answer Sheet

Name Marking Sheet

Completely fill the response oval representing the most correct answer.

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