

Topic Test: Mathematics and Driving

Total time allowed: 45 minutes Total marks: 35

1 Jill purchased a new car for \$29 000. Her trade-in covered one-quarter of the cost. How much more did Jill need to pay?

- A \$7250 B \$14500
C \$21 750 D \$36250

2 A car travels 9.45 km on each litre of petrol. Which of these is *not* a correct expression for this rate of fuel consumption?

- A 1.06 kL/km B 9.45 km/L
C 10.6 L/100 km D 945 km/100 L

3 Which of these depends on how often and how far the vehicle is driven?

- A CTP insurance
B registration
C interest charged on loan
D repairs

Use the following spreadsheet extract to answer Questions 4 and 5.

	A	B	C
1	Year	Value before depreciation	Depreciation
2	1	\$25 000.00	\$2000.00
3	2	\$23 000.00	\$1840.00
4	3	\$21 160.00	\$1692.80
5	4	\$19 467.20	\$1557.38
6	5	\$17 909.82	\$1432.79
7	6	\$16 477.04	\$1318.16
8	7	\$15 158.88	\$1212.71
9	8	\$13 946.17	\$1115.69

4 By what percentage has the vehicle depreciated in the first year?

- A 2.0% B 4.0%
C 6.0% D 8.0%

5 To calculate the value in cell B8, which command is used?

- A = B6 - B7
B = B7 - C7
C = B8 + C7
D = C2 + C3 + C4 + C5 + C6 + C7

6 A person has a BAC reading of 0.08. Which of the following is this reading *not* equal to?

- A $\frac{0.08}{100}$ grams per millilitre
B 0.08 grams per 100 millilitres
C 80 milligrams per 100 millilitres
D 8%

7 A person drives from Sydney to Broken Hill, a distance of 1144 km, in 12 hours 50 minutes. The average speed is closest to:

- A 75 km/h B 80 km/h
C 85 km/h D 90 km/h

8 Which one of these formulae is correct?

- A Reaction-time distance
= Braking distance + Stopping distance
B Braking distance
= Stopping distance + Reaction-time distance
C Stopping distance
= Reaction-time distance + Braking distance
D Stopping distance
= Reaction-time distance - Braking distance

9 The number of standard drinks in a container can be calculated using the formula:

$$N = 0.789 \times V \times A$$

where N = number of standard drinks

V = volume of the container (litres)

A = percentage of alcohol (% alc./vol.)
in the drink

The number of standard drinks in a 750 mL bottle of red wine with 13.0% alc./vol. is closest to:

- A 6.6 B 7.7
C 8.8 D 9.9

10 Blood alcohol concentration is affected by all of the following, except:

- A the amount of coffee you drink
B whether you are male or female
C your weight
D the number of drinks you consume

11 At 4:45 pm Don was clocked by the police radar as travelling at 93 km/h. This value is his:

- A average speed
- B instantaneous speed
- C timed speed
- D average velocity

12 Around school zones the posted speed is 40 km/h. This is closest to how many metres per second?

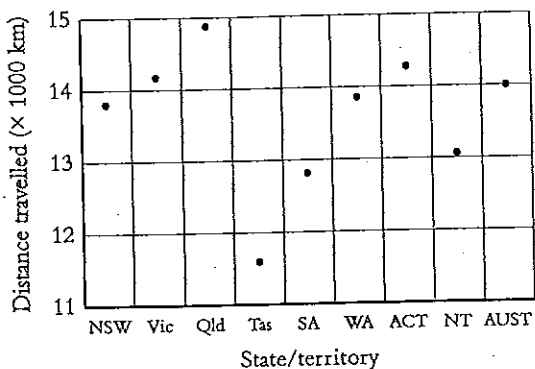
- A 7
- B 9
- C 11
- D 13

13 Australia has one of the highest rates of motor vehicle theft in the world, with around 84 000 motor vehicles stolen each year. There are around 16.7 million motor vehicles, including motorcycles, registered in Australia. Which of the following statements is *not* true?

- A There are around 230 vehicle thefts each day.
- B There are about 5 thefts annually for each 1000 vehicles registered.
- C The average chance of having your vehicle stolen is close to 0.5%.
- D All vehicles have equal chance of being stolen.

The following information refers to the next two questions.

Motor vehicles registered in Australia travelled an average of 14 000 kilometres per vehicle in 2012. This graph shows the average number of kilometres travelled by motor vehicles registered in different states/territories:



Source: Based on data from Australian Bureau of Statistics (2013). *Survey of motor vehicle use, Australia*. Cat. no. 9280. Accessed via www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0.

14 A vehicle in which state or territory averages an annual distance of more than South Australia but less than Victoria?

- A Queensland
- B Tasmania
- C Western Australia
- D Australian Capital Territory

15 Which of these statements is true?

- A Four states/territories average an annual distance per vehicle greater than the Australian average.
- B The range in distances travelled between states/territories is 4000 km.
- C New South Wales came closest to Western Australia for the distance travelled per vehicle.
- D The Australian average was obtained by adding the other numbers on the graph then dividing by 8.

16 Stamp duty on a vehicle is charged at the following rates:

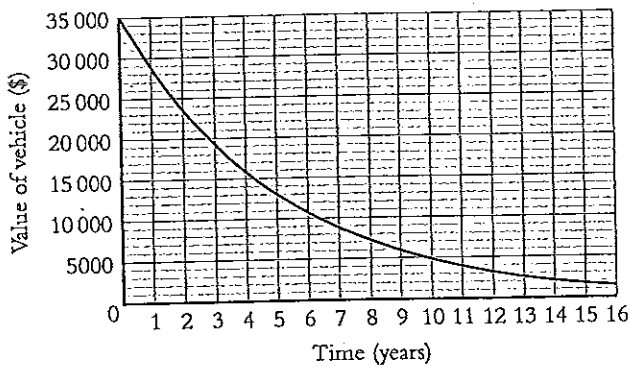
- \$44 999 or less: 3.6% for every \$100 or part thereof
- \$45 000 or more: \$1620 + 5% for the amount over \$45 000

What is the value of stamp duty for a car valued at:

a \$32 900? 1 mark

b \$65 300? 1 mark

17 The following graph shows the depreciation of a new vehicle at 18% p.a.:



a What is the value of the car initially? 1 mark

b By how much has the value of the car decreased in value during the:

i first year? 1 mark

ii sixth year? (between years 5 and 6) 1 mark

c At the beginning of the fourth year the value of the vehicle is \$15 825. Given that the car depreciates at 18% p.a., calculate the value of the car at the beginning of the fifth year. 1 mark

18 A petrol car uses 9.8 L/100 km. The diesel version of the same vehicle used 8.1 L/100 km of diesel fuel.

a Calculate the cost of driving the petrol version of the car for 1500 km given petrol costs 154.1¢/L. 1 mark

b Calculate the cost of driving the diesel version of the car for 1500 km given fuel costs 164.2¢/L. 1 mark

c How much cheaper is the diesel vehicle over this distance? 1 mark

- 19 A motorbike purchased for \$16 990 was worth \$8990 after 6 years. Using the straight line method of depreciation, calculate the annual amount of depreciation. 1 mark

- 20 An estimate of BAC can be found using the formulas:

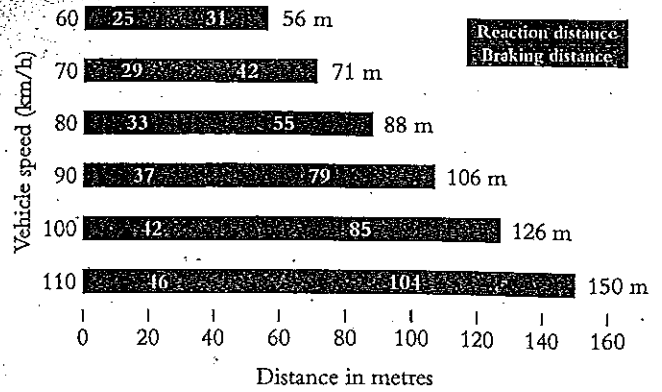
$$BAC_{\text{male}} = \frac{10N - 7.5H}{6.8M} \text{ and}$$

$$BAC_{\text{female}} = \frac{10N - 7.5H}{5.5M}$$

where N is the number of standard drinks consumed, H is the number of hours of drinking, and M is the person's mass (kg). Calculate the BAC of a 69 kg female who has consumed 5 standard drinks in 4 hours. 1 mark

- 21 A 95 kg adult male wants to keep his BAC below the legal limit of 0.05. How many standard drinks can he safely consume in 4.5 hours of drinking? 1 mark

- 22 The chart below shows total stopping distances for an average-sized vehicle:



Source: Available from Queensland Government Department of Transport and Main Roads website September 2013 at www.tmr.qld.gov.au/Safety/Driver-guide/Speeding/Stopping-distances.

- a What is the total stopping distance for a car travelling at 110 km/h? 1 mark
- b What is the reaction distance for a motorist travelling at 70 km/h? 1 mark
- c A child is observed by a motorist to dart out onto the street 110 metres away. What is the greatest speed the motorist can travel but still avoid hitting the child? 1 mark

23 This table describes Australian road fatality statistics in a recent calendar year:

State/territory	Road fatalities
NSW	376
Vic	282
Qld	280
SA	94
WA	185
Tas	33
NT	48
ACT	12
Total	1310

Source: Australian Department of Infrastructure and Transport (2012). *Road deaths Australia: Statistical report*. Accessed September 2013 via www.bitre.gov.au/publications/ongoing/files/RDA_Summary_2012_June.pdf.

- a Which state or territory had the highest fatalities? 1 mark
- b Does this necessarily indicate the drivers from this state are the most dangerous? Explain. 1 mark

24 Alcohol absorbed into the bloodstream can leave the body in two ways. Around 10% leaves through breath, perspiration and urine. The rest is broken down through metabolism by the liver. This is done at a constant rate.

The table below gives a guide to the time it takes for a person's metabolism to remove virtually all the alcohol from their bloodstream:

BAC level	Metabolism time
0.02	1 h 20 min
0.05	3 h 20 min
0.08	5 h 20 min
0.10	6 h 40 min

- a Estimate the time it will take a person with a very high BAC (blood alcohol concentration) level of 0.15 to have almost no alcohol in their bloodstream. 1 mark
- b Given that alcohol is metabolised at a constant rate every hour, by how much will their BAC drop for each hour after the person stops drinking? 1 mark
- c Comment on the statement that BAC can continue to rise for a period of time after the last drink is consumed. 1 mark

- 11 The trade-in amounted to $\frac{1}{4} \times \$29\,000 = \7250 , so she needs to pay $\$29\,000 - \$7250 = \$21\,750$ extra. ✓
- 12 All but 1.06 kL/km correctly describe the numbers given. You could have eliminated this one by using logic: $1.06 \text{ kL/km} = 1.06 \text{ L/m}$, which is saying it uses 1.06 litres to travel 1 metre! ✓
- 13 All costs except *repairs* are referred to as 'standing costs'. This means they still need to be paid even if the car was kept in the garage for the whole year and wasn't taken out onto the road. ✓
- 14 The vehicle depreciates by \$2000, which is $\frac{2000}{25000} \times 100 = 8\%$. ✓
- 15 To calculate the value of the vehicle for the year you need to subtract the amount of depreciation during the previous year from the previous year's value, which is $B7 - C7$. ✓
- 16 8% does not describe a BAC of 0.08. Since 0.08 represents 0.08 grams of alcohol per 100 mL of blood sample, the percentage is 0.08%. ✓
- 17 Average speed = $\frac{1144}{12 + \frac{50}{60}} = 89.14 \text{ km/h}$, which is closest to 90 km/h. ✓
- 18 Stopping distance is made up of two components: the distance travelled while the driver reacts to the situation, and the distance the car travels while the brakes are applied. ✓
- 19 $N = 0.789 \times 0.750 \times 13.0 = 7.69$, which rounds to 7.7 standard drinks (2 dec. places). ✓
- 20 This is a common misconception that drinking coffee will somehow neutralise the alcohol or, at the very least, 'fool' the breathalyser. Drinking copious quantities of coffee may give you the impression you are wide awake, but you are still under the influence. ✓
- 21 Instantaneous speed: a radar gun measures the speed at that instant. ✓
- 22 $40 \text{ km/h} = 40 \div 3.6 \text{ m/s} = 11.1 \text{ m/s}$ ✓
- 23 The chance a particular vehicle has of being stolen varies significantly depending on such factors as how expensive it is, how desirable it is to thieves, what security systems are in place, and where it is driven, parked and garaged. ✓
- 24 Western Australia, as you are looking for a state/territory that has a vehicle distance travelled between 12800 km and 14200 km. ✓
- 25 New South Wales came closest. All the other statements are incorrect. ✓

- 16 a Stamp duty = $\frac{3.6}{100} \times \$32\,900 = \1184.40 ✓
 b Stamp duty = $\$1620 + \frac{5}{100} \times (\$65\,300 - \$45\,000) = \2635 ✓
- 17 a \$35 000 ✓
 b i $\$35\,000 - \$28\,600 = \$6400$ ✓
 ii $\$13\,000 - \$10\,600 = \$2400$ ✓
 c Amount = $15\,825(1 - 0.18) = \$13\,926$ ✓
- 18 a Fuel used = $9.8 \times \frac{1500}{100} = 147 \text{ L}$
 Cost = $147 \times 154.1 = 22\,652.7$ cents or \$226.53 ✓
 b Fuel used = $8.1 \times \frac{1500}{100} = 121.5 \text{ L}$
 Cost = $121.5 \times 164.2 = 19\,950.3$ cents or \$199.50 ✓
 c The diesel vehicle is cheaper by $\$226.53 - \$199.50 = \$27.03$ ✓
- 19 Using $S = V_0 - Dn$, $8990 = 16990 - D \times 6$
 $\therefore D = \frac{16990 - 8990}{6} = \1333.33 ✓
- 20 BAC = $\frac{10 \times 5 - 7.5 \times 4}{5.5 \times 69} = 0.053$ ✓
- 21 $0.05 = \frac{10 \times N - 7.5 \times 4.5}{6.8 \times 95}$
 So $10N - 33.75 = 0.05 \times 646$
 $\therefore N = \frac{0.05 \times 646 + 33.75}{10} = 6.605$
 He would be best to stick to 6 or less drinks. ✓
- 22 a 150 m ✓
 b 29 m ✓
 c 90 km/h ✓
- 23 a New South Wales ✓
 b No, there are more drivers in New South Wales than in any other state/territory so, on a proportional basis, you would expect more fatalities in New South Wales. ✓
- 24 a Around 10 hours. This is a reason why people who are well over the limit from drinking the night before can be booked the next morning because their BAC could still be above 0.05. ✓
 b Take any two values in the table, for example, 0.10 and 6 h 40 min (6.67 h), to calculate the drop in BAC per hour = $\frac{0.10}{6.67} = 0.015$ ✓
 c There is still alcohol in the stomach and small intestines that is in the process of being absorbed into the bloodstream. ✓