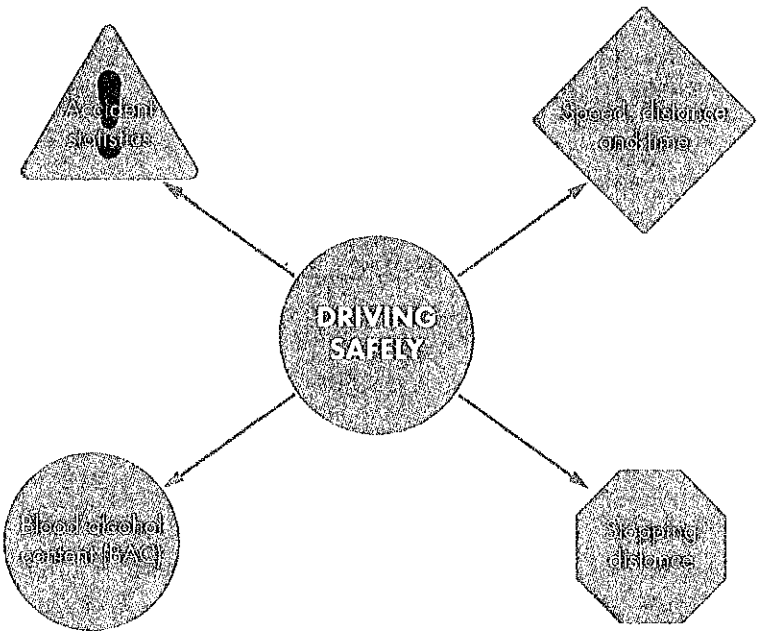
12. CHAPTER SUMMARY

This chapter, Driving safely, looked at the mathematics behind safe driving, covering the areas of measurement (blood alcohol, speed and stopping distance), algebra (formulas) and data analysis (road accident statistics). You should be familiar with the terminology, formulas, graphs and calculations involved with BAC, road accidents, speed and stopping distance.

Make a summary of this topic. Use the outline at the start of this chapter as a guide. An incomplete mind map is shown below. Use your own words, symbols, diagrams, boxes and reminders. Gain a 'whole picture' view of the topic and identify any weak areas.



ISBN 9780170413565

12. TEST YOURSELF

1 Jennifer weighs 56 kg and drank 3 glasses of wine at a party over 3 hours. She thought she was safe to drive but when pulled over and tested, she was over the legal limit of 0.05. She later discovered that each wine glass contained $1\frac{1}{2}$ standard drinks. Use the formulas $BAC_{\text{female}} = \dfrac{10N - 7.5H}{5.5M}$; Number of hours $= \dfrac{BAC}{0.015}$ to answer the following questions.

12.01

a What was her BAC, to three decimal places, when she was tested?

b How long, in hours and minutes, did it take before her BAC was back to zero?

c What would her BAC be, to three decimal places, after 3 standard drinks in 3 hours?

2 This table shows the BAC for women of different weights and number of drinks consumed in an hour.

12.01

Drinks per hour	Body weight (kg)						
	45	55	64	73	82	91	100
1	0.05	0.04	0.03	0.03	0.03	0.02	0.02
2	0.09	0.08	0.07	0.06	0.05	0.05	0.04
3	0.14	0.11	0.10	0.09	0.08	0.07	0.06

Sheridan is 64 kg. At a party, she consumed 2 drinks in the first hour and 3 drinks in the second hour.

a Calculate Sheridan's BAC:

- **i** at the start of the party
- **ii** after the first hour
- **iii** after the second hour.

b If Sheridan had no more drinks, how many hours until her BAC returns to zero? Assume that her body reduces her BAC at the rate of 0.018 per hour.

3 **a** Why is a heavier person less affected by alcohol?

b Why are females more affected by alcohol?

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4 This table shows the number of people killed in road crashes in an 8-year period in Australia.

Road fatalities in Australia for 2008–2015				
	Drivers		Passengers	
Year	Male	Female	Male	Female
2008	495	175	177	125
2009	521	186	182	148
2010	470	166	154	129
2011	422	146	158	126
2012	459	151	124	136
2013	393	164	101	102
2014	386	146	109	118
2015	424	131	117	132

Source: Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2016, Road trauma Australia, 2015 statistical summary BITRE, Canberra ACT.

a What is the mean number of male drivers killed per year?

b What is the range of female passengers killed over the 8 years?

c In 2015, what percentage (correct to one decimal place) of drivers killed were male?

d In 2015, what percentage (correct to one decimal place) of females killed were drivers?

e What do you notice when you compare the numbers of drivers with the number passengers killed each year? Give a reason why this may be so.

f What is the median number of female drivers killed per year?

g Is the number of drivers killed each year generally increasing or decreasing? Give a reason why this may be so.

5 This table shows the number of Australian fatal crashes over 7 years categorised by number of vehicles and pedestrians involved.

Year	Single-vehicle crashes	Multiple-vehicle crashes	Pedestrian crashes	Total crashes
2009	649	509	189	1347
2010	544	520	169	1233
2011	504	463	184	1151
2012	520	503	167	1190
2013	515	430	156	1101
2014	463	438	149	1050
2015	491	447	163	1101

Source: Bureau of Infrastructure, Transport and Regional Economics (BITRE), 2016, Road trauma Australia, 2015 statistical summary BITRE, Canberra ACT.

a Which category of crash shows a steady decline over the years until 2015?

b In 2015, what percentage (correct to one decimal place) of crashes involved pedestrians?

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c True or false? There are always more single-vehicle crashes than multiple-vehicle crashes.

d Which year had the highest number of:

i multiple-vehicle crashes? **ii** crashes overall?

e Calculate the percentage increase (to one decimal place) in single-vehicle crashes between 2014 and 2015.

f Draw a sector graph to display the data for 2015.

6 Scott took $2\frac{3}{4}$ h to drive from Canberra to Bodalla, 200 km away. 12.03

a What was his average speed, correct to the nearest km/h?

b How long, in hours and minutes, would it take him to drive 430 km to Newcastle at this speed?

c How far, to the nearest km, could he travel at this speed in 5 hours?

7 A truck driver was travelling in the Northern Territory at 150 km/h on a road with no speed limits. He began braking 3 seconds after he saw a sign to a truck stop. If he travelled 810 m under brakes before coming to a stop, how far did he travel after seeing the sign? 12.04

8 George is travelling on a dry road at 65 km/h and sees a cow in the middle of the road about 70 m ahead. He takes 1.2 s to apply the brakes, then travels 24 m under brakes before coming to a stop. Did he hit the cow? Give reasons for your answer. 12.04

9 The following measurements were taken in a school zone. 12.04

Stopping distances on a wet road in a school zone			
Reaction time (s)	Reaction distance (m)	Braking distance (m)	Stopping distance (m)
1	11.1	12.6	A
2	22.2	12.6	B
4	44.4	12.6	C

The speed limit in a school zone during school hours is 40 km/h.

a What do you notice about the braking distances?

b What do you notice about the reaction distances?

c Find the values of **A**, **B** and **C**.

d If an 85-year-old driver in a school zone has a slow reaction time of 4 s, would he stop in time if he sees a child crossing the road 50 m ahead?

e Suggest two strategies for this driver that would help him avoid any accidents when driving.

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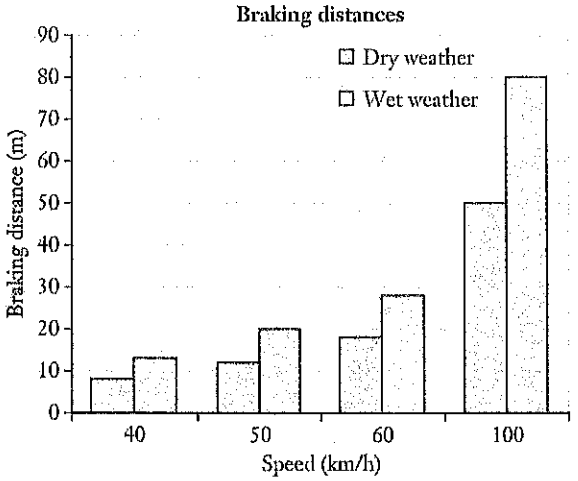
10 This graph gives the braking distance for a car travelling on a dry or wet road at various speeds.



a What is the difference in braking distance on a dry road for two cars travelling at 50 km/h and 100 km/h respectively?

b How much further will a car travel under brakes on a wet road at 60 km/h than on a dry road at the same speed?

c If a car travels 50 m under brakes on a dry road, what is its approximate speed?

d What is the approximate speed of a car on a dry road that travels 12 m after the brakes are applied?

Chapter quiz

e Write a sentence noting any similarities or differences between braking distances on wet and dry roads, giving reasons for your answer.

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SOLUTIONS

5 **a** 7.9 m **b** 11.1 m
c Both would stop in time. Hanna in 30.1 m and Fran in 19 m.

6 **a** 14.4 m **b** 17.7 m
c Sanjay (52.3 m)

7 **a** $k = 0.0097$ **b** 106.9 m **c** 88 km/h
d **i** 97.6 m **ii** 153.6 m

8 **a** $k = 0.0068$ **b** 61.1 m
c 153.5 m

9 **a** 33 m **b** 102 m **c** 145 m **d** 238 m

10 **a** 1.88 s **b** 99 m

11 **a** 181 **b** 145 **c** 153 **d** 126

12 **a** 0.007 46 **b** 90.3 m **c** 151 m

13 **a** 5500 m **b** 32 500 m **c** 46 500 m

14 **a** 160 m
b **i** 108 m **ii** 133 m **iii** 180 m
c

road	reaction time	stopping distance
dry	1	78
dry	2	105
dry	4	160
wet		105
wet	2	135
wet	4	190

d You can see exact values in a table but a graph gives a good visual overall picture of the situation.

Sample HSC problem

a 0.15 **b** 4 **c** 10
d 0.03, rate at which BAC is increasing with each drink consumed.
e 16 h

Test yourself 12

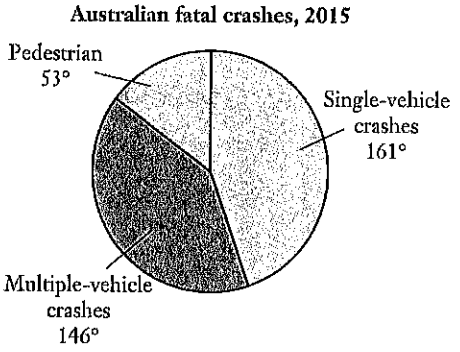
1 **a** 0.073 **b** 4 h 52 min **c** 0.024

2 **a** **i** 0 **ii** 0.07 **iii** 0.17
b 9 h 27 min

3 **a** Heavier people have more blood and water in their bodies to dilute alcohol.
b Females tend to be lighter than males.

4 **a** 446.25 **b** 46
c 76.4% **d** 49.8%
e More drivers are killed than passengers. There are more drivers than passengers in cars overall (many cars have no passengers), drivers sit in the car where they are more likely to be injured
f 157.5
g Generally decreasing (despite increasing populations). Better road safety campaigns, more policing, safer cars and roads.

5 **a** Single-vehicle **b** 14.8% **c** True
d **i** 2010 **ii** 2009
e 6.0%
f



6 **a** 73 km/h **b** 5h 55 min
c 364 km

7 935 m

8 No, he travels 21.7 m before he applies the brakes so his stopping distance is 21.7 m + 24 m = 45.7 m.

9 **a** same
b increases as reaction time increases
c A = 23.7 B = 34.8 C = 57
d No, he needs 57m to stop.
e Drive slower than the speed limit, get someone else to drive you.

10 **a** about 38 m **b** 10 m
c 100 km/h **d** 50 km/h
e It takes much longer to stop on a wet road. If the speed is double, the distance is not. For example, at 100 km/h on a wet road it takes 4 times as long to stop as it does at 50 km/h.

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