Sample Preliminary examination 3

Total time allowed: 2 hours **Total marks:** 85

Sample exam 3

Section 1 (Suggested time: 35 minutes)

Multiple-choice questions **25 marks**

- **Attempt ALL questions.**
- **All questions are of equal value.**
- **Select the alternative (A, B, C or D) that best answers the question.**

1 The number 416.296 correct to two significant figures is:

A 416.29 B 416.30
C 420 D 42

2 A speed of 2.3 m/s is closest to:

A 6 km/h B 8 km/h
C 10 km/h D 12 km/h

3 If $x^5 = 2.5$ then, correct to one decimal place, $x =$

A 0.5 B 1.2
C 11.5 D 64.4

4 Express the number four-hundred and thirty-seven million in standard notation.

A 437 000 000 B 437×10^6
C 4.37×10^6 D 4.37×10^8

5 The surface (SA) area of a sphere is 1226 cm^2. If $SA = 4\pi r^2$ then the diameter of the sphere is closest to:

A 3 cm B 6 cm
C 9 cm D 20 cm

6 The base length l of a square pyramid of volume V and perpendicular height h is given by $l = \sqrt{\frac{3V}{h}}$. Find l correct to one decimal place if $V = 652$ and $h = 7.8$.

A 5.7 B 15.8
C 250.8 D 700.4

7 A used car is offered for sale at \$6975. If this car is 25% off the original price, then the original price was:

A \$1744 B \$5230
C \$8719 D \$9300

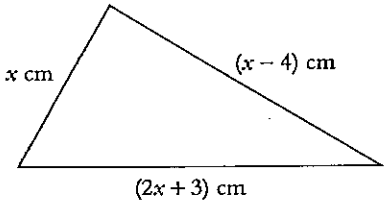
8 Write 348 659 000 correct to the nearest million.

A 340 000 000 B 348 000 000
C 349 000 000 D 348 600 000

9 $3 - 2(a - 6)$ equals:

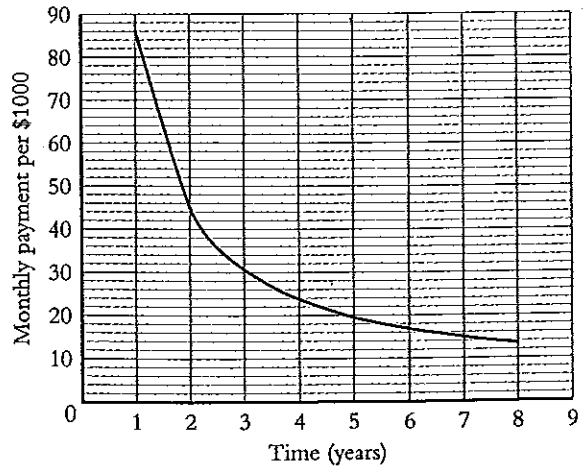
A $a - 6$ B $-2a - 9$
C $2a - 12$ D $15 - 2a$

10 If the perimeter of the given triangle is 31 cm, calculate the value of x.



A 8 B 4
C 7 D 6

11 The graph shows the monthly repayment for each \$1000 on a reducing balance loan at an interest rate of 7% p.a.:



Demetrios borrows \$15 000 to purchase a car. The amount he repays over 5 years is closest to:

A $15 \times 5 \times 12 \times 20$ dollars

B 15000×20 dollars

C $15 \times 5 \times 20$ dollars

D $15000 \times 12 \times 20$ dollars

12 Gloria and Hugh Myers invested \$2000 and \$4600 respectively in a business. If the profit was \$3300, how much would Gloria get if they divide the profit in the ratio of their investment?

A \$330 B \$2000

C \$1270 D \$1000

13 If $x = 9$ then the value of $x^{\frac{5}{2}}$ is:

A 243 B 59 049

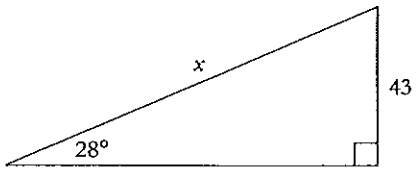
C 3 D 2408

14 Use your calculator to evaluate to three significant figures: $\dfrac{4.67 \times \sin 28°}{\sqrt{4.6 \times 10^6}}$

A 1.02 B 0.06

C 2.89×10^7 D 1.02×10^{-3}

15



The value of x is given by:

A $43 \times \cos 28°$ B $43 \times \sin 28°$

C $\dfrac{43}{\cos 28°}$ D $\dfrac{43}{\sin 28°}$

16 Peter has a mobile phone contract that charges a monthly access fee of \$45, free calls \$120, a flagfall on each call of \$0.23 and a call rate of \$0.33 for each 30 seconds. Suppose Peter made 180 calls during the month, each lasting just under 1 minute. What is his total monthly charge?

A \$40.20 B \$85.20

C \$100.80 D \$118.80

17 The cash price for a computer is \$1990. The computer could be bought on terms for 20% deposit and \$36 per week for 1 year. What is the saving if it is bought for cash?

A \$118 B \$280

C \$398 D \$1872

18 One card is drawn from a normal pack. The probability that the card is either a heart or a king is:

A $\dfrac{17}{52}$ B $\dfrac{1}{52}$

C $\dfrac{4}{13}$ D $\dfrac{16}{51}$

19 In a Christmas cake recipe the ratio of dried fruit to flour to sugar is 7:4:1. A 350 g packet of dried fruit is used to make the cake. How much flour is needed?

A 50 g B 200 g

C 612.5 g D 1400 g

20 The simple interest I on a loan of P at r% for n years is given by the formula $I = Prn$.

Find I when an amount of \$10 000 is borrowed at a rate of 5% p.a. for 3 years.

A \$1000 B \$500

C \$1200 D \$1500

21 The length of a rectangle is 3 cm more than its width. If the width is w cm, what is the area of the rectangle?

A $w^2 + 3$ cm^2 B $w^2 + 3w$ cm^2

C $3w$ cm^2 D $w^2 + 4$ cm^2

22 If $y = 5x - 2x^2$, find the value of y when $x = -2$.

A -18 B -2

C 2 D 18

23 The number of significant figures in a distance recorded as 2150 km is:

A exactly 2 B exactly 3

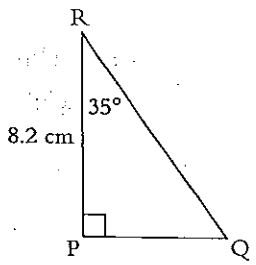
C exactly 4 D 3 or 4

24 Sophie works in a shop between 11:30 am and 3:30 pm every weekday. Her weekly wage is $225. What is her hourly rate of pay?

A $45 B $11.25
C $8.04 D $15

25 What is the length of PQ correct to one decimal place?

A 4.7 cm
B 5.7 cm
C 6.7 cm
D 7.7 cm



Sample exam 3

Section 2 (Suggested time: 85 minutes)

Objective-response questions 60 marks

- Attempt ALL questions.
- Each question is worth 15 marks.
- Show all working.

26 a Angelo normally works a 35-hour week at $10.20 an hour. By working overtime, he earns an extra $84.15. Calculate:

i his total weekly wage 1 mark

ii how many hours overtime he worked if he was paid time-and-a-half for the overtime hours. 2 marks

b A portable radio is offered for sale either for $300 cash or on terms of 20% deposit and $22.40 monthly over 12 months.

i What is the amount of the deposit? 1 mark

ii After the deposit is paid, what is the balance of the cash price still owing? 1 mark

iii Calculate the total amount to be paid by this customer. 2 marks

iv How much more than the cash price will this customer pay? 2 marks

v The extra cost found in part iv is the interest charged on the balance of the cash price still owing. Find the percentage rate of interest being charged. 2 marks

c Michael wants to go on an overseas holiday and decides to borrow $2300 from a finance company offering an interest rate of 9% flat p.a. He wants to repay the loan and interest in 18 months.

i How much interest will he pay? 2 marks

ii What will be the amount of each monthly instalment? (Answer to the nearest cent.) 2 marks

27 a Evaluate, correct to two decimal places:

$$x = \frac{15\sin 91°}{\sin 67°}$$ 1 mark

b A phone plan charges 28 cents per SMS up to 256 characters. Find the cost of sending:

i two messages, each with 110 characters 1 mark

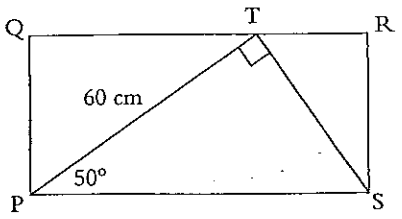
ii one message of 220 characters. 1 mark

c From the top of a tower 90 metres high, the angle of depression to a person is 55°.

i Draw a diagram to clearly show this information. 1 mark

ii How far (to the nearest metre) is the person from the base of the tower? 1 mark

d PQRS is a rectangle.
T is a point on QR such that $\angle PTS = 90°$, $\angle TPS = 50°$ and TP = 60 cm.



Find:

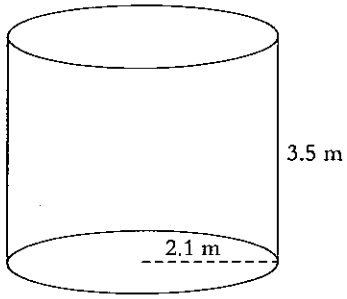
i TS correct to one decimal place 1 mark

ii PS correct to one decimal place 1 mark

iii PQ correct to one decimal place 1 mark

iv the area of each triangle correct to the nearest cm^2. 4 marks

e An iron water tank is in the shape of a closed cylinder, with a radius of 2.1 m, and a height of 3.5 m.



Determine the:

i area of the base (to the nearest 0.1 of a square metre) 1 mark

ii volume of the tank in m^3 and hence its capacity to the nearest litre. 2 marks

28 a A surveyor conducts a traverse survey of a field and makes these entries in a notebook. (All measurements are in metres.)

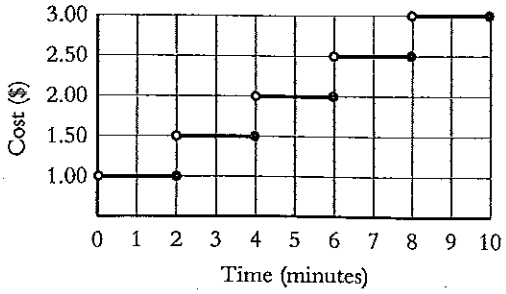
	B	
	30	8 D
C 12	27	
	15	20 E
	0	
	A	

i Draw a sketch (not to scale) of the field. 3 marks

ii Find the area of the field. 4 marks

iii What is the length of AE? 2 marks

b Use this step graph showing the cost of calls to answer the following question:



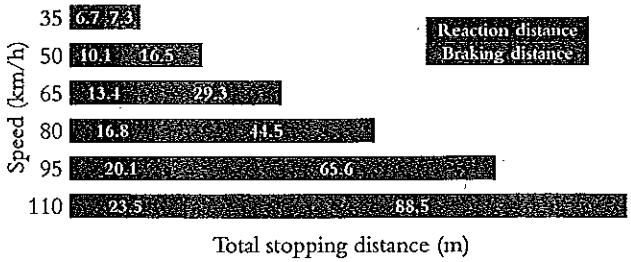
Four calls are made, lasting $3\frac{1}{4}$ minutes, then 6 minutes 35 seconds, then 9 minutes 40 seconds, and one final call. The total cost is $8.50. What is a possible time length of the final call? 2 marks

c i One terabyte of memory size is 2^{40} bytes. Write this number in scientific notation, correct to three significant figures. 1 mark

ii How many times larger is a terabyte than a megabyte? 1 mark

d How many MP3 files with an average size of 3.6 MB each can be stored on a 4 GB MP3 player? 2 marks

29 a The diagram shows the total stopping distances (in metres) for the average car travelling at different speeds:



i Stopping distance consists of Reaction distance + Breaking distance. Explain the difference between these two terms. 2 marks

ii What is the total stopping distance for a car travelling at 80 km/h? 1 mark

iii A girl runs onto the road after a ball. If this occurs 80 m in front of a car travelling at 95 km/h, will the car be able to stop in time? 1 mark

b The number, N, of people in a town is given by the formula $N = 3000e^{0.05t}$ where t is the number of years since 1980.

i What was the population of the town in 1980? 2 marks

ii Find the expected number of people living in the town in the year 2030. 2 marks

c State three factors that are impaired when a driver drinks excessive amounts of alcohol. 3 marks

d The table shows the monthly repayment for each $1000 borrowed on a reducing balance personal loan:

	Interest rate				
Year	8%	9%	10%	11%	12%
4	$24.41	$24.89	$25.36	$25.85	$26.33
5	$20.28	$20.76	$21.25	$21.74	$22.24
6	$17.53	$18.03	$18.53	$19.03	$19.55
7	$15.59	$16.09	$16.60	$17.12	$17.65
8	$14.14	$14.65	$15.17	$15.71	$16.25

Geoffrey borrows $18 000 to help finance the purchase of his new car. This loan is to be repaid over 7 years at 10% p.a., reducible.

i Calculate the amount of each monthly repayment. 1 mark

ii Calculate the total payment on the loan. 1 mark

iii How much *more* would he have paid in total if the loan was taken out at 12% p.a., reducible? 2 marks

Go to p. 245 for **Quick Answers**
or to pp. 271–275 for **Worked Solutions.**

Worked Solutions

Sample Preliminary examination 3
Section 1 ..... pp. 231–233

1 $416.296 = 420$ [2 s.f.] ✓

2 $2.3 \text{ m/s} = 2.3 \times 60 \times 60 \text{ m/h}$

$= 8280 \text{ m/h}$

$= \frac{8280}{1000} \text{ km/h}$

$= 8.28 \text{ km/h}$

Or you can simply calculate this by dividing by 3.6. ✓

3 $x^5 = 2.5$

$x = (2.5)^{\frac{1}{5}}$)

$x \approx 1.201\,125\,434$ [Cal.]

$x = 1.2$ [1 d.p.] ✓

4 $437\,000\,000 = 4.37 \times 10^8$ ✓

5 $4\pi r^2 = 1226$

$r^2 = \frac{1226}{4\pi}$

$r = \sqrt{\frac{1226}{4\pi}}$

$r = 9.877\,346\ldots$ [Cal.]

Diameter $= 2r = 2 \times 9.877\,346\ldots$

$= 19.754\,693\,63\ldots$

∴ The diameter of the sphere is closest to 20 cm. ✓

Worked Solutions to Chapter 10

6 $l = \sqrt{\frac{3V}{h}} = \sqrt{\frac{3 \times 652}{7.8}} = 15.8$ [1 d.p.] ✓

7 75% of the original price = \$6975

1% of the original price = $\frac{\$6975}{75}$

100% of the original price = $\frac{\$6975}{75} \times 100$

= \$9300 ✓

8 348 659 000 = 349 000 000 [to nearest million] ✓

9 $3 - 2(a - 6) = 3 - 2a + 12$

$= 15 - 2a$ ✓

10 $x - 4 + 2x + 3 + x = 31$

$4x - 1 = 31$

$4x = 31 + 1$

$4x = 32$

$x = 32 \div 4$

$x = 8$ ✓

11 From the graph the monthly repayment for 5 years is close to \$20 for each \$1000 borrowed. Since Demetrios borrowed \$15 000, then his repayments are 15 (thousand dollars) × 5 (years) × 12 (months in a year) × 20 (the figure from the graph). ✓

12 Gloria : Hugh

2000 : 4600

10 : 23

Total parts = 10 + 23 = 33

Profit = \$3300

33 parts = \$3300

1 part = $\frac{\$3300}{33}$ = \$100

∴ 10 parts = 10 × \$100

= \$1000

Gloria's share = \$1000 ✓

13 $x^{\frac{5}{2}} = 9^{\frac{5}{2}}$

$= (3^2)^{\frac{5}{2}}$

$= 3^5$

$= 243$ ✓

14 $\frac{4.67 \sin 28°}{\sqrt{4.6 \times 10^6}} = 1.022\,226\,783\ldots \times 10^{-3}$

$= 1.02 \times 10^{-3}$ [3 s.f.] ✓

15 $\frac{43}{x} = \sin 28°$

$43 = x \sin 28°$

$x \sin 28° = 43$

$x = \frac{43}{\sin 28°}$ ✓

16 Each call costs \$0.23 + 2 × \$0.33 = \$0.89. So all the calls cost \$0.89 × 180 = \$160.20. Now he gets a \$120 discount on these calls, but you also need to add in the monthly access fee. He pays \$160.20 − \$120 + \$45 = \$85.20. ✓

17 Cash price = \$1990

Price paid = 20% × \$1990 + \$36 × 52

= \$398 + \$1872

= \$2270

If bought for cash, saving = \$2270 − \$1990

= \$280 ✓

18 $P(E) = \frac{n(E)}{n(S)}$ $\quad [n(E) = 16,\ n(S) = 52]$

$= \frac{16}{52}$

$= \frac{4}{13}$ ✓

19 Dried fruit : Flour : Sugar

7 : 4 : 1

A packet of 350 g of dried fruit is used.

∴ 7 parts = 350 g

1 part = 350 g ÷ 7

= 50 g

4 parts = 50 g × 4

∴ Amount of flour used = 200 g ✓

20 P = \$10 000, r = 5% p.a., n = 3 years

$I = Prn$

$I = 10\,000 \times 5\% \times 3$

I = \$1500 ✓

21 $(w + 3)$ cm

w cm

Area = $w(w + 3)$

$= w^2 + 3w$ cm^2 ✓

Worked Solutions to Chapter 10

22 $y = 5x - 2x^2$
$= 5(-2) - 2(-2)^2$
$= -10 - 2(4)$
$= -10 - 8$
$= -18$ ✓

23 The distance of 2150 km may be rounded to the nearest 10 km, or to the nearest km, therefore it could have 3 or 4 significant figures. ✓

24 Number of hours worked in a week $= 4 \times 5$
$= 20$

Hourly rate of pay $= \frac{\$225}{20}$
$= \$11.25$ ✓

25 $\frac{PQ}{8.2} = \tan 35°$
$PQ = 8.2 \tan 35°$
$= 5.7$ cm ✓

Sample Preliminary examination 3 Section 2 . . . . . pp. 233–235

26 a i His total weekly wage $= 35 \times \$10.20 + \$84.15$
$= \$441.15$ ✓

ii Amount earned for overtime for which he is paid 'time-and-a-half' = \$84.15
Number of hours worked overtime
$= \frac{84.15}{1.5 \times 10.20}$ ✓
$= 5\frac{1}{2}$ hours ✓

b Cash price = \$300

i Deposit = 20% of \$300
$= 20\% \times \$300$
$= \$60$ ✓

ii Balance owing $= \$300 - \$60$
$= \$240$ ✓

iii Total amount to be paid $= 12 \times \$22.40 + \$60$
$= \$328.80$ ✓✓

iv Extra amount to be paid by the customer
$= \$328.80 - \$300$ ✓
$= \$28.80$ ✓
∴ The interest charged by the customer = \$28.80.

v $\begin{bmatrix} \text{Principal} = P = \$240 \\ \text{Time} = n = 1 \text{ year} \\ \text{Rate} = r = ? \end{bmatrix}$

∴ Simple interest $= Prn$ ✓
$28.80 = 240 \times r \times 1$
$= 240r$
$\therefore r = \frac{28.80}{240}$
$r = 0.12$
$r = 12\%$ p.a. ✓

c i $\begin{bmatrix} P = \$2300 \\ r = 9\% \text{ p.a.} \\ n = 1\frac{1}{2} \\ I = ? \end{bmatrix}$

Interest $= Prn$
$= \$2300 \times 9\% \times 1\frac{1}{2}$ ✓
$= \$310.50$ ✓

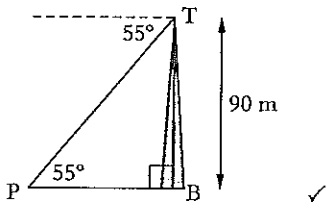
ii Total amount to be paid $= \$2300 + \$310.50$
$= \$2610.50$ ✓
Total number of months = 18
Monthly instalment $= \frac{\$2610.50}{18}$
$= \$145.027\ldots$ [Cal.]
$= \$145.03$ [to nearest cent] ✓

27 a $x = \frac{15 \sin 91°}{\sin 67°}$
$x = 16.292\,92\ldots$ [Cal.]
$x = 16.29$ [2 d.p.] ✓

b i Cost $= 28¢ + 28¢ = 56¢$ ✓

ii Cost $= 28¢$ ✓

c i



✓

ii $\frac{90}{PB} = \tan 55°$
$\frac{90}{\tan 55°} = PB$
$PB = 63.018\ldots$ [Cal.]
$PB = 63$ m [to nearest metre] ✓

d i $\frac{TS}{60} = \tan 50°$
$TS = 60 \tan 50°$
$TS = 71.5052\ldots$ [Cal.]
$TS = 71.5$ cm ✓

Worked Solutions to Chapter 10

ii $\cos 50° = \dfrac{60}{PS}$

$PS \cos 50° = 60$

$PS = \dfrac{60}{\cos 50°}$

$PS = 93.3434...$ [Cal.]

$PS = 93.3$ cm ✓

iii In right-angled $\triangle PQT$

$\dfrac{PQ}{60} = \cos 40°$

$PQ = 60 \cos 40°$

$PQ = 45.9626...$ [Cal.]

$PQ = 46.0$ cm ✓

iv $A_{PTS} = \dfrac{1}{2} \times PT \times TS$

$= \dfrac{1}{2} \times 60 \times 71.5$

$= 2145$ cm^2 ✓

$A_{PQT} = \dfrac{1}{2} \times PQ \times QT$

$= \dfrac{1}{2} \times 46 \times (\sqrt{60^2 - 46^2})$ [by Pythagoras' Theorem] ✓

$= \dfrac{1}{2} \times 46 \times 38.5227...$

$= 866.0225...$ [Cal.]

$= 866$ cm^2 ✓

$A_{TRS} = \dfrac{1}{2} \times TR \times RS$

$= \dfrac{1}{2} \times (93.3 - 38.5227...) \times 46$

$= 1259.8774...$ [Cal.]

$= 1260$ cm^2 ✓

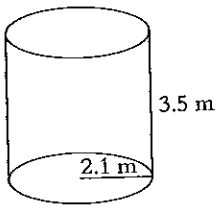
e i Area of the base $= \pi r^2$

Area of the base $= \pi(2.1)^2$

Area of the base $= 13.854\,4236...$ m^2 [Cal.]

Area of the base $= 13.9$ m^2

[to nearest 0.1 of a square metre] ✓



ii Volume of the tank

$= \pi r^2 h$ [1 mL = 1 cm^3, 1000 mL = 1 m^3]

$= \pi(2.1)^2 \times 3.5$ m^3

$= 48.4904...$ m^3 [Cal.]

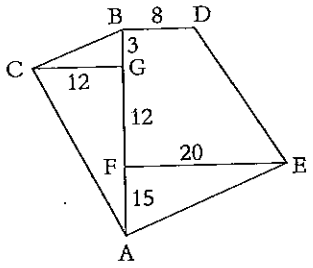
$= 48.5$ m^3 [1 d.p.] ✓

∴ The capacity of the tank

$= (48.490\,482\,61 \times 1000)$ litres

$= 48\,490$ litres [to the nearest litre] ✓

28 a i



✓✓✓

ii Area of $\triangle ABC = \dfrac{1}{2} \times 30 \times 12$

$= 180$ m^2 ✓

Area of $\triangle AFE = \dfrac{1}{2} \times 20 \times 15$

$= 150$ m^2 ✓

Area of trapezium BDEF $= \dfrac{1}{2} \times 15\,(8 + 20)$

$= 7.5(28)$

$= 210$ m^2 ✓

Total area $= 180 + 150 + 210$ m^2

$= 540$ m^2 ✓

iii $AE^2 = 15^2 + 20^2$ ✓

$AE^2 = 225 + 400$

$AE^2 = 625$

$AE = \sqrt{625}$

$AE = 25$ m ✓

b Call costs so far are \$1.50 + \$2.50 + \$3.00 = \$7.00.

There remains \$1.50, ✓ for which you can make a call lasting from 2 to 4 minutes. ✓

c i $2^{40} = 1.10 \times 10^{12}$ bytes ✓

ii 1 TB $= 2^{40}$ bytes. 1 MB $= 2^{20}$ bytes. So it is $2^{40} \div 2^{20} = 2^{20}$ (or 1 048 576) times larger. ✓

d There are 2^{10} (1024) gigabytes in 1 MB, so a 4 GB MP3 player can store 4×1024 MB = 4096 MB. ✓

The number of files is therefore $4096 \div 3.6 = 1137.8$.

It can store 1137 files (rounding down). ✓

Worked Solutions to Chapter 10

29 a i Reaction distance is the distance the car travels between the driver seeing the problem and actually applying the brakes. ✓ Braking distance is the actual time it takes the car to come to a complete stop once the brakes are applied. ✓

ii $16.8 + 44.5 = 61.3$ m ✓

iii Total stopping distance $= 20.1 + 65.6 = 85.7$ m
Since 85.7 m > 80 m, the car will not stop in time ✓

b i $N = 3000e^{0.05t}$
$N = 3000e^{0}$ ✓ [when $t = 0$]
$N = 3000 \times 1$
$N = 3000$ ✓

ii $N = 3000e^{0.05 \times 50}$
$N = 3000e^{2.5}$ ✓
$N = 36547.481\ldots$ [Cal.]
$N = 36547$ ✓

c Any three of these factors can be named: *judgement* (ability to reason and respond satisfactorily); *comprehension* (ability to understand a situation rapidly); *concentration* (ability to focus on the task at hand); and *reaction time* (the ability to take action to a situation swiftly). ✓✓✓

d i Monthly $= \$16.60 \times 18 = \$298.80$ ✓

ii Total $= \$298.80 \times 12 \times 7 = \$25\,099.20$ ✓

iii At 12% p.a., the monthly payment is $\$17.65 \times 18 = \$317.70$, making the total repayment $\$317.70 \times 12 \times 7 = \$26\,686.80$ ✓
The difference is $\$26\,686.80 - \$25\,099.20$
$= \$1587.60$ ✓