



CRANBROOK  
SCHOOL

## Year 10 5.2/5.3 & 9 Acc Mathematics

### Half Yearly Assessment, 2013

SOLUTIONS

Total Marks: 86

Time allowed: 100 minutes

All questions must be answered in a separate writing booklet  
Show all working to gain full marks

Section A (23 marks)

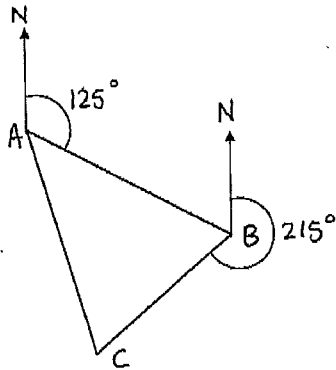
Marked by HRK

START A NEW BOOKLET

1. Factorise and simplify
  - a.  $9-9(x+y)^2$  2
  - b.  $\frac{y}{x^2-xy} + \frac{2x-y}{x^2-2xy+y^2}$  3
  - c.  $\frac{a^2-8a-ab+8b}{b-a}$  3
2. First factorise and then solve this quadratic equation  $5t^2-11t+2=0$  2
3.
  - a. Factorise and solve  $x^2-4x-21=0$  2
  - b. Using your answer to part a., find the solutions to the following equation  $(x+3)^2-4(x+3)-21=0$  1
4. Complete this perfect square:  $x^2-\frac{3}{7}x+ \underline{\hspace{1cm}} = (\quad)^2$  1
5. Solve  $2x^2-10x-3=0$  by completing the square.  
Give your answers correct to 2 decimal places. 3
6. Use the quadratic formula to solve  $x^2+6x+2=0$  leaving your answer in simplest surd form. 3
7. The base of a triangle is 3cm longer than its height.  
If the area of the triangle is  $35\text{cm}^2$ 
  - a. Draw a sketch showing this information clearly 1
  - b. Form a quadratic equation and solve it to find the height. 2

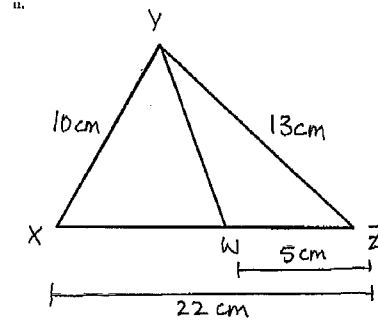
START A NEW BOOKLET

1. A ladder of length 3 metres is leaning against a wall and is inclined at  $62^\circ$  to the ground.
  - a. Draw a diagram to represent this information. 1
  - b. Calculate how far the ladder reaches up the wall. Round your answer correct to 2 dp. 1
  
2. Oscar drives 165km on a bearing of  $145^\circ$ . He then drives due west until he is due south of his starting point.
  - a. Draw a diagram illustrating this information. 1
  - b. Calculate how far he is from his starting point. Answer to the nearest kilometre. 1
  
3. David sails a ship from port A and travels 155 nautical miles to a lighthouse B on a bearing of  $125^\circ$ . He then sails 112 nautical miles to a port C on a bearing of  $215^\circ$ .

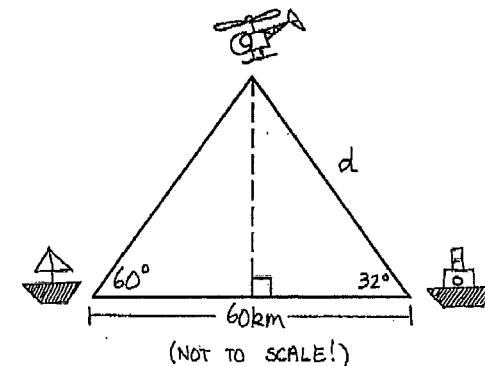


Find the bearing of Port C from Port A. Answer to the nearest degree. 3

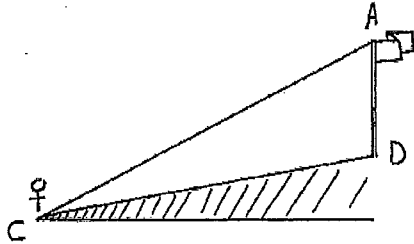
4. Consider the following diagram:



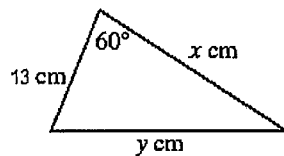
- a. Find the size of  $\angle YXZ$ . Correct to the nearest minute. 2
  - b. Find the length of YW. Correct to 1 decimal place. 2
- 
5. Two boats are situated at sea level 60 km apart. A helicopter is sighted simultaneously by the two boats where the angles of elevation of the helicopter from the boats at this time are  $60^\circ$  and  $32^\circ$ .
    - a. Find the length of distance  $d$ . 2
    - b. Find the altitude of the helicopter correct to the nearest 100 metres. 2



6. Blair is standing at C on a path that leads to the base D of a vertical flagpole. The path is inclined at  $16^\circ$  to the horizontal and the angle of elevation to the top A of the flagpole from C is  $45^\circ$ .



- a. Explain why  $\angle ACD = 29^\circ$  and  $\angle CDA = 106^\circ$  2
- b. Given that CD is 30m, find the height of the flagpole. Answer to the nearest metre. 2
7. The area of this triangle is  $35\sqrt{3} \text{ cm}^2$ . Find the value of  $x$  and the exact value of  $y$ . 3



**Section C (22 marks)**

**Marked by RABS**

**START A NEW BOOKLET**

1. Solve the following. Show all necessary working to gain full marks.
- a.  $\sin 2x = \cos 78^\circ$  2
- b.  $\frac{5}{\sin \theta} = \frac{3}{\cos \theta}$  2
2. Prove  $\frac{\cos \theta \sin(90^\circ - \theta)}{\sin \theta \cos(90^\circ - \theta)} = \frac{1}{\tan^2 \theta}$  2
3. Find the exact values of the following expressions, showing all working. Ensure that your answer is a single fraction with a rational denominator. Full marks will not be awarded if you use a calculator.
- a.  $\sin^2 60^\circ$  2
- b.  $2 \sin 30^\circ - \cos^2 30^\circ + \tan 45^\circ$  2
- c.  $\cos 315^\circ$  2
- d.  $\tan 120^\circ$  2
4. Solve the following for  $0^\circ \leq \theta \leq 360^\circ$ .
- a.  $\tan \theta = \frac{1}{\sqrt{3}}$  2
- b.  $\sin \theta = -\frac{1}{2}$  2
- c.  $2 \cos^2 \theta = 1$  4

## START A NEW BOOKLET

1. Calculate the simple interest after 5 years of an investment of \$6400 at 7.5% p.a. 1
  
2. Craig invests \$7900 at 5.25% p.a compound interest. Find the value of this investment after 6 years if the interest compounds yearly. 1
  
3. Simon paid \$18 500 to buy equipment for his business. If the rate of depreciation is 15% p.a., find the value of the equipment after 7 years. 1
  
4. Peter buys a guitar with a cash price of \$9 800 on the following terms:  
15% deposit with the balance paid at \$92.75 per week for 2 years.  
Assume there are 52 weeks in one year.  
  
Calculate:
  - a. the deposit. 1
  - b. the balance owing. 1
  - c. the *total* cost of the guitar. 1
  - d. the total interest paid on the loan. 1
  
5. James invests \$12800 at 12% p.a compound interest. Find the value of this investment after 4 years if the interest compounds quarterly. 2
  
6. How much do you need to invest today at 5.2% p.a. annually compounding interest, to have \$16 000 in 3 years?  
Express your answer correct to the nearest dollar. 2

7. Jess deposited \$11 500 in a savings account. After 3 years he had earned \$1250 in simple interest. Find the annual interest rate correct to one decimal place. 2

8. Use the table below to answer the following questions. *Show all working.*

Monthly repayment per \$1000 borrowed.

Term	Interest Rate (p.a.)					
	6%	7%	8%	9%	10%	11%
6	\$16.57	\$17.05	\$17.53	\$18.03	\$18.53	\$19.03
7	\$14.61	\$15.09	\$15.59	\$16.09	\$16.60	\$17.12
8	\$13.14	\$13.63	\$14.14	\$14.65	\$15.17	\$16.25
9	\$12.01	\$12.51	\$13.02	\$13.54	\$14.08	\$14.63
10	\$11.10	\$11.61	\$12.13	\$12.67	\$13.22	\$13.78
11	\$10.37	\$10.88	\$11.42	\$11.96	\$12.52	\$13.09

Amelia borrows \$190 000 over 10 years at 9% p.a. to purchase a house.

- a. How much will Amelia repay altogether on this loan? 1
  - b. How much interest will she pay? 1
  - c. Calculate the flat yearly interest rate, correct to 2 decimal places. 2
9. A motor bike was purchased for \$5600 and 5 years later its value had depreciated to \$2900. Find the annual rate of depreciation. 2

SECTION A (23 MARKS)  $\sqrt{=1 \text{ MARK}}$

a)  $9 - 9(x+y)^2$

$\sqrt{= 9(1 - (x+y)^2)}$

$= 9(1 - (x+y))(1 + (x+y))$

$\sqrt{= 9(1-x-y)(1+x+y)}$

DIFF OF 2 SQUARES  
BUT.....  
Always take out any  
common factors FIRST  
- NO MATTER WHAT IF  
looks like/leads to.

b)  $\frac{y}{x^2 - xy} + \frac{2x - y}{x^2 - 2xy + y^2}$

FIRST FACTORISE  
BOTH DENOMINATORS

PUT ON LOWEST CD

$= \sqrt{\frac{y}{x(x-y)} + \frac{2x-y}{(x-y)^2}}$

$= \frac{(x-y)y + x(2x-y)}{x(x-y)^2}$

$= \frac{xy - y^2 + 2x^2 - xy}{x(x-y)^2}$

$= \frac{2x^2 - y^2}{x(x-y)^2}$

c)  $\frac{a^2 - 8a - ab + 8b}{b-a}$

4 terms - do 2 AT A TIME

$= \frac{a(a-8) - b(a-8)}{b-a}$

NOTE:  $b-a = -(a-b)$

$= \frac{(a-8)(a-b)}{-1(a-b)}$

then denom. is -1

$= \frac{a-8}{-1} = -a+8$  or  $8-a$

Q2 RTQ READ THE QUESTION

FIRST FACTORISE

When told to factorise,  
if you do not factorise  
you will lose marks!

$5t^2 - 11t + 2 = 0$  ✓

$(5t-1)(t-2) = 0$

$t = \frac{1}{5}, 2$  ✓

Q3 a) RTQ AGAIN..... IN FACT EVERY TIME!!!

$x^2 - 4x - 21 = 0$  ✓  $(x-7)(x+3) = 0$   
 $x = 7, -3$  ✓

b) & AGAIN RTQ! using (a)

$(x+3)^2 - 4(x+3) - 21 = 0$  NOTE SAME PATTERN!!  
SO HERE  $ao(a)$

$x+3 = 7$  or  $x+3 = -3$

$\therefore x = 4$  or  $x = -6$  ✓

Q4 RTQ I MUST FOLLOW QUESTION REQUEST  
& REMEMBER

To complete the square we add the  
square of  $\frac{1}{2}$  the coefficient of  $x$

HERE  $(\frac{-3}{14})^2$  noting  $\frac{1}{2} \times \frac{-3}{7} = \frac{-3}{14}$

$\therefore x^2 - \frac{3}{7}x + (\frac{-3}{14})^2 = (x - \frac{3}{14})^2$  ✓

OBSERVE THAT (BY LEAVING THE HALF OF  
 $-\frac{3}{7}$  i.e.  $-\frac{3}{14}$  we have exactly what  
must go in the bracket)

5/  $2x^2 - 10x - 3 = 0$   
 1ST DIVIDE BY 2  
 i.e. make sure coefficient of  $x^2$  is 1

$$\frac{2x^2}{2} - \frac{10x}{2} - \frac{3}{2} = \frac{0}{2}$$

$$x^2 - 5x - \frac{3}{2} = 0 \quad \checkmark \text{ PUT NUMBER ON RHS}$$

$$x^2 - 5x = \frac{3}{2}$$

COMPLETE THE SQUARE  $\left(\frac{-5}{2}\right)^2$

$$x^2 - 5x + \left(\frac{-5}{2}\right)^2 = \frac{3}{2} + \frac{25}{4}$$

$$\left(x - \frac{5}{2}\right)^2 = \frac{31}{4} \quad \text{NOW Square root}$$

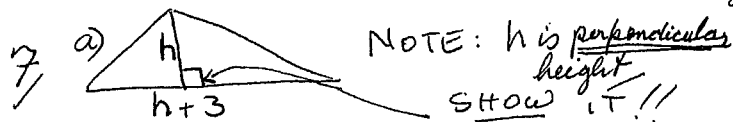
$$x - \frac{5}{2} = \pm \sqrt{\frac{31}{4}} \quad \checkmark \text{ both sides Remember } (+)$$

$$x - \frac{5}{2} = \pm \frac{\sqrt{31}}{2} \quad \text{Make } x \text{ subject \& RTQ !!!!}$$

$$x = \frac{5}{2} \pm \frac{\sqrt{31}}{2} = \frac{5 \pm \sqrt{31}}{2} = 5.28, -0.28 \quad \checkmark \text{ (2dp)}$$

6/  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$  THIS MUST BE KNOWN

$$= \frac{-6 \pm \sqrt{36 - 8}}{2} = \frac{-6 \pm \sqrt{28}}{2} = \frac{-6 \pm \sqrt{4 \cdot 7}}{2} = \frac{-6 \pm 2\sqrt{7}}{2} = -3 \pm \sqrt{7}$$



b)  $A = \frac{1}{2}bh$   
 $35 = \frac{1}{2}(h+3)h$   
 i.e.  $70 = h^2 + 3h$   
 $h^2 + 3h - 70 = 0$   
 $(h+10)(h-7) = 0$   
 $\therefore h = -10, 7$  BUT  $h > 0$  as it is a distance  $\therefore h = 7\text{cm}$



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Teacher Initials

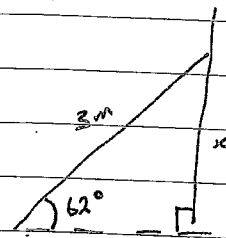
SECTION B SOLUTIONS

Student Name

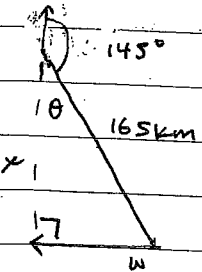
ASSESSMENT WRITING BOOKLET

Subject: YR 10 HALF YEARLY EXAM 2013

Start here.

(1a)  (✓)

(1b)  $\sin 62 = \frac{x}{3}$   
 $3 \sin 62 = x$   
 $x = 2.65\text{m}$  (✓)

(2a)  (✓)

Start here.

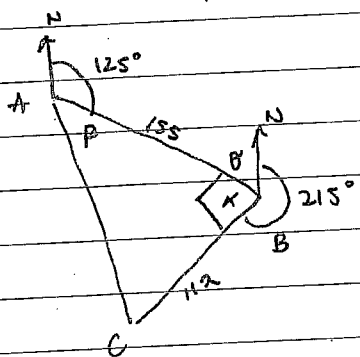
$$(2b) \theta = 180 - 145 = 35^\circ$$

$$\cos 35^\circ = \frac{x}{165}$$

$$x = 165 \cos 35^\circ = 135 \text{ km}$$

(✓)

3



$$\theta = 180 - 125 = 55^\circ \text{ (co-interior angles)}$$

$$\angle = 360 - 55 - 215 = 90^\circ \text{ (}\angle \text{ at a point)}$$

(✓)

B can be found using SOH CAH TOA since  $\triangle ABC$  is a  $\perp$  triangle

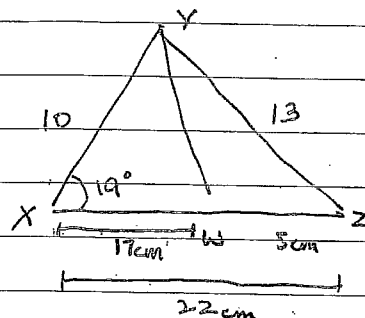
$$\tan B = \frac{112}{155}$$

$$B = 35^\circ 52'$$

(✓)

$$\therefore \text{Bearing of C from A is } 125^\circ + 35^\circ 51' = 161^\circ \text{ (}\checkmark\text{)}$$

(4a)



$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$\cos X = \frac{10^2 + 22^2 - 13^2}{2(10)(22)}$$

(✓)

$$= 19^\circ 24'$$

(✓)

$$(1b) c^2 = a^2 + b^2 - 2ab \cos C$$

$$XW = 22 - 5$$

$$YW^2 = 10^2 + 17^2 - 2(10)(17) \cos 19^\circ = 17 \text{ cm (}\checkmark\text{)}$$

$$YW^2 = 68 \dots$$

$$YW = 8.265 \dots$$

$$= 8.3 \text{ cm}$$

(✓)

Start here.

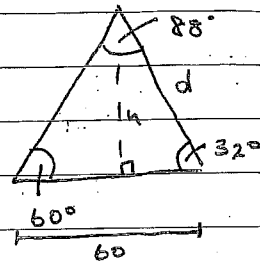
(5a)  $\angle$  at helicopter =  $180 - 60 - 32$   
 $= 88^\circ$

$$\frac{d}{\sin 60} = \frac{60}{\sin 88}$$

$$d = \frac{60 \sin 60}{\sin 88}$$

$$d = 51.993 \dots$$

$$= 52 \text{ km} \quad (\checkmark)$$



(5b)  $\sin 32^\circ = \frac{h}{52 \dots}$

$$h = 52 \dots \sin 32$$

$$= 27.55 \dots \text{ km}$$

$$= 27600 \text{ m} \text{ or } 27.6 \text{ km} \quad (\checkmark)$$

(6)  $\angle$  ACD =  $45 - 16$  adjacent  
 $= 29^\circ$  ( $\angle$  ~~sum~~)

$$\angle$$
 CDA =  $180 - 29 - \angle$  CAD

$$180 - 45 = 45$$

$$\angle$$
 CDA =  $180 - 29 - 45$

$$= 106^\circ \quad (\angle \text{ sum of } \Delta) \quad (\checkmark)$$



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Teacher Initials

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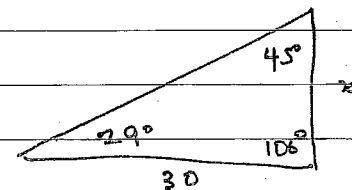
Student Name

### ASSESSMENT WRITING BOOKLET

Subject:

Start here.

(6b)



$$\frac{\sin 30}{\sin 45} = \frac{z}{\sin 29} \quad (\checkmark)$$

$$z = \frac{30 \sin 29}{\sin 45}$$

$$= 20.568 \dots \quad (\checkmark)$$

$$= 21 \text{ m}$$

(7)  $A = \frac{1}{2} ab \sin C$

$$= \frac{1}{2} \times 13 \times z \times \sin 60$$

$$35\sqrt{3} = \frac{1}{2} \times 13 \times z \times \frac{\sqrt{3}}{2}$$



Start here.

$$35\sqrt{3} = \frac{13\sqrt{3}x}{4} \quad (\div \sqrt{3})$$

$$x = 10\frac{10}{13} \text{ cm} \quad (\checkmark)$$

$$y^2 = 13^2 + \left(10\frac{10}{13}\right)^2 - 2 \times 13 \times 10\frac{10}{13} \times \cos 60^\circ \quad (\checkmark)$$

$$y = 10.97... \quad 12.04...$$

$$y = \text{Area } 12 \text{ cm} \quad (\checkmark)$$

### SECTION C.

1a.  $\sin 2x = \cos 78^\circ$

$$78^\circ + 2x = 90^\circ \checkmark \quad \text{COMPLEMENTARY } \Delta s.$$
$$2x = 12^\circ$$
$$x = 6^\circ \checkmark$$

b.  $\frac{5}{\sin \theta} = \frac{3}{\cos \theta} \quad \times \text{ BOTH SIDES BY } \sin \theta$

$$5 = \frac{3 \sin \theta}{\cos \theta} \quad \div \text{ BOTH BY } 3$$

$$\frac{5}{3} = \frac{\sin \theta}{\cos \theta} \quad \frac{\sin \theta}{\cos \theta} = \tan \theta$$

$$\frac{5}{3} = \tan \theta \checkmark$$

$$\theta = \tan^{-1} \left(\frac{5}{3}\right)$$
$$= 59^\circ 2' \checkmark$$

- NOT ANSWERED PARTICULARLY WELL.
- MANY HAD NO IDEA WHAT TO DO. PLEASE REVIEW CLASS EXERCISES IN YOUR STUDY.
- SLOPPINESS WITH NOTATION (ie 6 not 6°) WAS COMMON.

$$2. \text{ LHS} = \frac{\cos \theta \sin (90^\circ - \theta)}{\sin \theta \cos (90^\circ - \theta)}$$

$$= \frac{\cos \theta \cdot \cos \theta}{\sin \theta \cdot \sin \theta}$$

$$= \frac{\cos^2 \theta}{\sin^2 \theta}$$

$$= \frac{1}{\tan^2 \theta}$$

$$= \text{RHS}$$

$$\text{AS } \frac{\sin^2 \theta}{\cos^2 \theta} = \tan^2 \theta$$

- ANSWERED WELL.

- SOME DID NOT SHOW ENOUGH LINES OF WORKING & SKIPPED TOO MANY STEPS.

- ONLY A FEW MADE THE ERROR OF PICKING A RANDOM ANGLE & SUBSTITUTING IN.

$$3a. \sin^2 60^\circ = (\sin 60^\circ)^2$$

$$= \left(\frac{\sqrt{3}}{2}\right)^2 \quad \checkmark \quad \text{USING EXACT VALS.}$$

$$= \frac{3}{4} \quad \checkmark$$

$$b. 2 \sin 30^\circ - \cos^2 30^\circ + \tan 45^\circ$$

$$= 2 \times \frac{1}{2} - \left(\frac{\sqrt{3}}{2}\right)^2 + 1 \quad \checkmark \quad \text{USING EXACT VALS.}$$

$$= 1 - \frac{3}{4} + 1$$

$$= \frac{1}{4} \text{ OR } \frac{5}{4} \quad \checkmark$$

$$c. \cos 315^\circ \dots \text{IN Q4} \therefore \text{+ve.}$$

$$315^\circ = 360^\circ - \theta \quad \checkmark$$

$$\therefore \theta = 45^\circ$$

$$\cos 45^\circ = \cos 315^\circ = \frac{1}{\sqrt{2}} \text{ OR } \frac{\sqrt{2}}{2} \quad \checkmark$$

(LEEWAY WAS GIVEN FOR LEAVING  $\frac{1}{\sqrt{2}}$  WITH AN IRRATIONAL DENOM.)

$$d. \tan 120^\circ \dots \text{IN Q2} \therefore \text{-ve.}$$

$$120^\circ = 180^\circ - \theta \quad \checkmark$$

$$\therefore \theta = 60^\circ$$

$$\tan 60^\circ = \sqrt{3}$$

$$\therefore \tan 120^\circ = -\sqrt{3} \quad \checkmark$$

- MANY SHOWED THAT THEY REALLY DID NOT UNDERSTAND THE METHOD FOR 'ANGLES OF ANY MAGNITUDE' & WENT STRAIGHT TO THEIR CALC.

- WORKING OUT WAS GENERALLY POORLY SET OUT OR MISSING.

$$4a. \tan \theta = \frac{1}{\sqrt{3}}$$

+ve in Q1, Q3

Q1:  $\theta = 30^\circ$  (FROM EXACT VALS.)

Q3:  $180^\circ + 30^\circ = 210^\circ$

$$\therefore \theta = 30^\circ, 210^\circ \quad \checkmark$$

$$b. \sin \theta = -\frac{1}{2}$$

-ve in Q3, Q4.

IF  $\sin \theta = \frac{1}{2}$ ,  $\theta = 30^\circ$  (EXACT VALS.)

$$Q3: 180^\circ + 30^\circ = 210^\circ$$

$$Q4: 360^\circ - 30^\circ = 330^\circ$$

$$\therefore \theta = 210^\circ, 330^\circ$$

$$c. 2 \cos^2 \theta = 1$$

$$\cos^2 \theta = \frac{1}{2}$$

$$\therefore \cos \theta = \pm \frac{1}{\sqrt{2}} \quad (\text{NOTE: BOTH +VE \& -VE})$$

$\therefore$  WE HAVE TO LOOK IN 4 QUADRANTS:

$$Q1: \theta = 45^\circ \checkmark$$

$$Q2: 180^\circ - 45^\circ = 135^\circ \checkmark$$

$$Q3: 180^\circ + 45^\circ = 225^\circ \checkmark$$

$$Q4: 360^\circ - 45^\circ = 315^\circ \checkmark$$

- NOT ANSWERED PARTICULARLY WELL.
- MANY STUDENTS, AGAIN, HAD NO STRUCTURE TO THEIR WORKING.
- KNOWLEDGE OF EXACT VALUES WAS POOR.
- MANY STUDENTS MISSED THE  $\pm \frac{1}{\sqrt{2}}$ .
- GO BACK OVER WORKED EXAMPLES FROM CLASS.



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SECTION D.

Student Name

### ASSESSMENT WRITING BOOKLET

Subject:

Start here.

$$\begin{aligned} Qn1. \quad I &: PRT \\ &= \$6400 \times 0.075 \times 5 \\ &= \$2400 \quad \checkmark \end{aligned}$$

$$\begin{aligned} Qn2. \quad A &= P(1+R)^n \\ &= \$7900(1+0.0525)^6 \\ &= \$10738.90 \quad \checkmark \end{aligned}$$

$$\begin{aligned} Qn3. \quad V &= P(1-R)^n \\ &= \$18500(1-0.15)^7 \\ &= \$5930.68 \quad \checkmark \end{aligned}$$

Start here.

$$\text{Qm 4 (a) deposit} = \$9800 \times 0.15$$

$$= \$1470 \quad \checkmark$$

$$\text{(b) balance} = \$9800 - 1470$$

$$= \$8330 \quad \checkmark$$

$$\text{(c) Total cost} = \$1470 + (\$92.75 \times 52 \times 2)$$

$$= \$11116 \quad \checkmark$$

$$\text{(d) Interest} = \$11116 - 9800$$

$$= \$1316 \quad \checkmark$$

$$\text{Qm 5. } A = P(1+R)^n$$

$$= \$12800(1+0.03)^{16} \quad \checkmark$$

$$= \$20540.24 \quad \checkmark$$

$$\text{Qm 6. } A = P(1+R)^n$$

$$\$16000 = P(1+0.052)^3 \quad \checkmark$$

$$P = \frac{\$16000}{(1.052)^3}$$

$$P = \$13742.72 \quad \checkmark$$

$$\text{Qm 7. } I = PRT$$

$$\$1250 = \$11500 \times R \times 3 \quad \checkmark$$

$$1250 = 34500R$$

$$R = \frac{1250}{34500}$$

$$R = 0.0362$$

$$\therefore \text{Interest Rate} = 3.6\% \text{ p.a.} \quad \checkmark$$

$$\text{Qm 8. (a) Total repayment} = \$12.67 \times 190 \times 12 \times 10$$

$$= \$288876 \quad \checkmark$$

$$\text{(b) Interest} = \$288876 - 190000$$

$$= \$98876 \quad \checkmark$$

$$\text{(c) Interest Rate} = \frac{\$98876 \div 10}{190000} \times 100 \quad \checkmark$$

$$= 5.2\% \quad \checkmark$$

$$\text{Qm 9. } V = P(1-R)^n$$

$$2900 = 5600(1-R)^5 \quad \checkmark$$

$$\frac{2900}{5600} = (1-R)^5$$

$$\sqrt[5]{\frac{2900}{5600}} = 1-R$$

$$R = 1 - \sqrt[5]{\frac{2900}{5600}}$$

$$R = 0.12331 \dots$$

$$\text{Interest rate} = 12.3\% \quad \checkmark$$

Additional writing space on back page

Notes

\* It was common for students to round off to the nearest dollar, even when not asked.

\* Qn 7 and Qn 9 were poorly done. Students struggled to solve the equation once they had correctly substituted the correct values in the formula.

ie: solving:  $52900 = 5600(1-R)^5$

and

$$1250 = 11500 \times R \times 3$$