Section I
20 marks

Attempt Questions 1–20
Allow about 30 minutes for this section
Use the multiple choice answer sheet

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1 The position coordinates of a point 18° north of (12° S, 22°W) is;

A (30° N, 22°W)

B (12° S, 40°W)

C (12° S, 4°W)

D (6° N, 22°W)

2 In the formula $S = \frac{a}{1-r}$, find the value of S when $a = 20$ and $r = \frac{1}{6}$

A $19\frac{5}{6}$

B 24

C 32

D 48

3 Water is dripping from a tap at a rate of 70 drops per minute. Each drop is 0.4mL. How many litres drip from the tap in 5 hours?

A 8.4 L

B 0.875 L

C 35 L

D 52.5 L

4 The speed limit in the Eastern Distributor tunnel is 80km/h. This speed expressed in metres per second to one decimal place is;

A 22.0

B 2.2

C 0.2

D 22.2

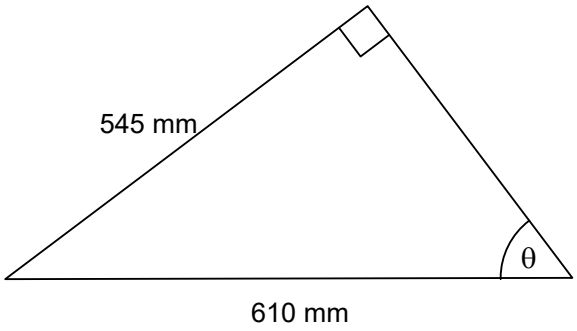
5 Find, correct to the nearest degree, the size of angle θ.

A 27°

B 30°

C 60°

D 63°



6 Anne works at Big-Y Department Store and is paid $11·20 per hour for a 38-hour week.

Calculate Anne's pay in a week where she works 5 hours at time-and-half in addition to her regular hours.

A $425.60

B $481.60

C $509.60

D $722.40

7 Simplify $12m^4n^3 \times 4mn^2$

A $3m^5n^5$

B $48m^4n^6$

C $48m^5n^5$

D $60m^8n^6$

8 The value of $\frac{4.6}{\sqrt{2.5+9.8}}$, correct to two significant figures is:

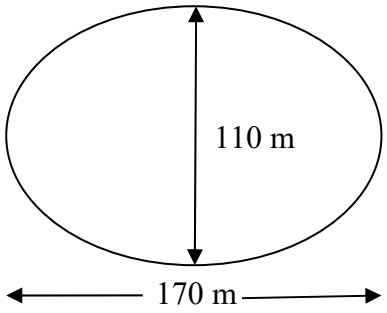
A 0.76

B 1.3

C 1.31

D 4.97

9 A Melbourne Council wishes to fertilize one of its AFL grounds which is in the shape of an ellipse, as shown in the diagram.



Fertilizer costs $1.25 per square metre.

What will be the cost to fertilise the AFL ground to the nearest $10?

A $73 430

B $18 360

C $36 720

D $36 710

10 The table below is used to calculate the compound value that \$1 will amount to under a certain investment condition.

	Interest rate per period				
Periods	1%	2%	3%	4%	5%
1	1.010	1.020	1.030	1.040	1.050
2	1.020	1.040	1.061	1.082	1.103
3	1.030	1.061	1.093	1.125	1.158
4	1.041	1.082	1.126	1.170	1.216
5	1.051	1.104	1.159	1.217	1.276
6	1.062	1.126	1.194	1.265	1.340

Mary-Rose plans to invest \$5 500 at 4% p.a. for 2 years, with interest compounded six-monthly.

What will her investment amount to?

A \$5 500

B \$5 624.45

C \$5 951

D \$6 200

11 The solution to the equation $2(4x-3)-7x=19$ is

A $x=13$

B $x=16$

C $x=22$

D $x=25$

12 Bob the builder bought building supplies to the value of \$4 600 and then received a trade discount of 15%. If the account is paid within 30 days, a further 3% reduction of the discounted price applies. The account was paid within 30 days.

How much did Bob pay?

A \$828

B \$3 772

C \$3 792.70

D \$4 579.30

13 A rectangle has dimensions 18 cm by 12 cm correct to the nearest centimetre. The area of the rectangle will lie between;

A 212.75 cm^2 and 231.25 cm^2

B 201.25 cm^2 and 231.25 cm^2

C 201.25 cm^2 and 218.75 cm^2

D 212.75 cm^2 and 218.75 cm^2

14 Brian invested \$6 000 for 5 years compounding annually. At the end of that time his investment had compounded to \$10 500. The interest rate correct to 1 decimal place was;

A 15.0%

B 11.8%

C 35.0%

D 9.4%

15 When it is noon in Greenwich, the local time in Vancouver (49° N, 123°W) is;

A 8:12 pm

B 3:48 am

C 3:16 pm

D 8:44 am

16 The radius of a sphere of volume 695 m^3, correct to one decimal place is;

A 11.8 cm

B 40.5 cm

C 51.5 cm

D 5.5cm

17 In triangle ABC, AB = 32 m, AC = 50 m and angle A = 25°. The area of the triangle to the nearest square metre is;

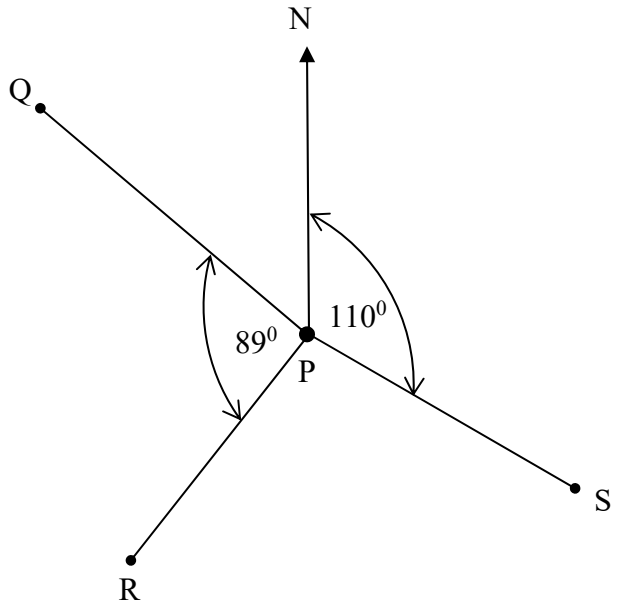
A 25 m²

B 47 m²

C 338 m²

D 800 m²

18 The bearing of S from P is 110° and Q is NW of P. The angle QPR is 89°.
The bearing or R from P is;



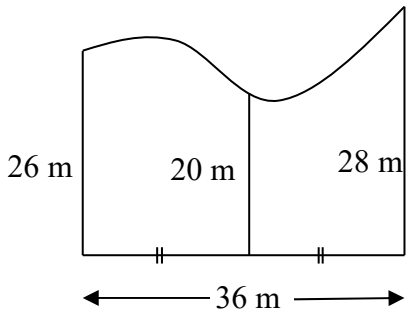
A 134°

B 244°

C 155°

D 226°

19 Using Simpson's Rule, the nearest approximation to the area of the field drawn is;



A 600 m²

B 700 m²

C 800 m²

D 900 m²

20 Peter calculates the present value (N) of an annuity. The interest rate is 4% p.a compounded monthly. In 5 years the future value will be $100 000.

Which of the calculations below will result in the correct answer?

A $N = \dfrac{100\,000}{(1+0.04)^5}$

B $N = \dfrac{100\,000}{(1+0.04\div 12)^5}$

C $N = \dfrac{100\,000}{(1+0.04)^{60}}$

D $N = \dfrac{100\,000}{(1+0.04\div 12)^{60}}$

End of Section I

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Section II

60 Marks

Attempt Questions 21–23
Allow about 1.5 hours for this section

Answer each question in a separate answer booklet, clearly labelled with your student number.

All necessary working should be shown in every question.

Marks

Question 21 (20marks) Use a SEPARATE answer booklet.

(a) Evaluate $\frac{4.8 \times 10^5}{6.4 \times 10^{-2}}$, giving your answer in scientific notation. **1**

(b) Solve the equation $4(2y - 2) = 5y + 19$ **2**

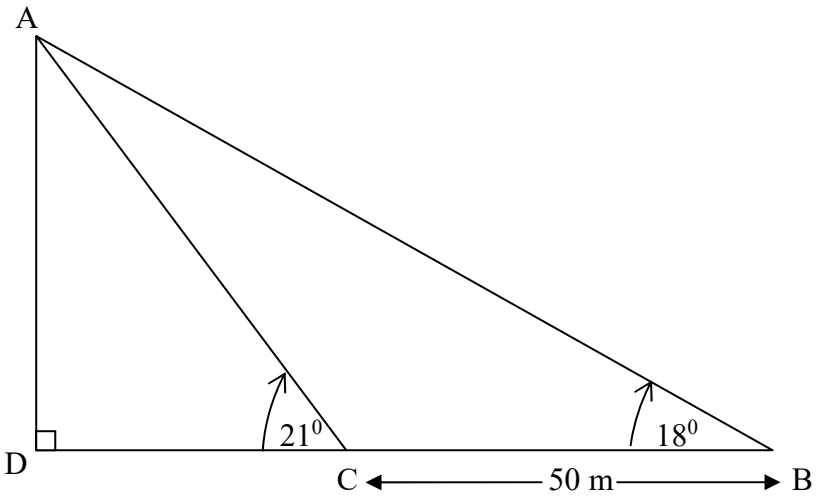
(c) A computer system is purchased for $ 5 800. Its depreciation can be calculated using a straight line depreciation of $1 200 p.a. or by using a declining balance rate of 30% p.a.

(i) Find the value of the system after 3 years using the declining balance method. **2**

(ii) Which method will give the system the greater value after 3 years? Justify your answer with calculations **2**

Question 21 continued. **Marks**

(d) A radio transmission tower stands on level ground. A surveyor, at B, sights the top of the tower (A) and notes its angle of elevation is 18°. He then walks 50 m towards the tower to C and notes its angle of elevation is 21° as illustrated in the diagram.



(i) Determine the size of ∠BAC. **1**

(ii) Use the Sine rule to find the length of AC correct to the nearest metre. **3**

(iii) Hence find the height AD of the radio transmission tower correct to the nearest metre. **2**

Question 21 continued. **Marks**

(e) Allan is a surveyor for Valley Heights Council and his scale survey drawing is shown below.

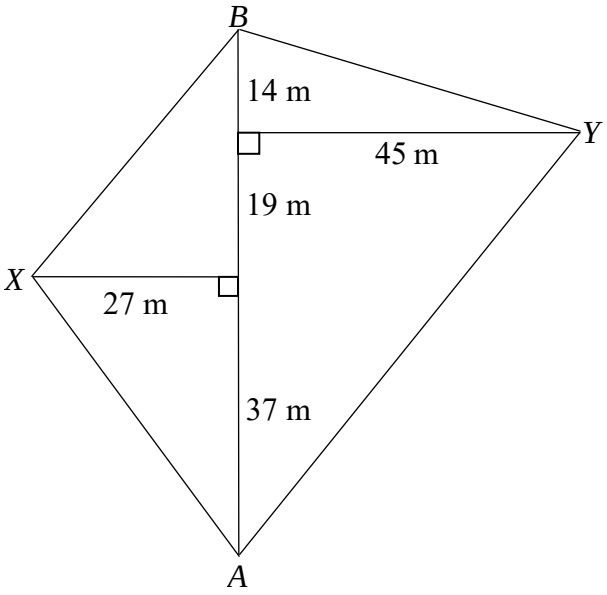


Fig 1

Scale: 1 mm = 1 m

(i) The park, *AXBY*, is to have a 1.8 m high fence placed around its perimeter.
By accurate measurement determine how much fencing is required, to the nearest metre? **2**

(ii) As part of a government grant the park is to be planted with native trees. If a tree can be planted for every 12 m^2 of space, how many trees can be planted in the park?
(Note: we must assume there are NO trees in the park at present) **3**

(f) A plane leaves Chicago (42°N, 88°W) at 8 am and flies to Rome (42°N, 12°E) **2**
If the flying time is 5 hours 30 minutes at what local time did the plane arrive in Rome.

End of Question 21

Question 22 (20 marks) Use a SEPARATE answer booklet.

Marks

(a) A cylindrical can has a diameter of 6.5 cm and a height of 11 cm.
The curved surface area of the can is covered completely with a label, without any overlapping.

Find, to one decimal place, the

(i) circumference of the base of the can. **2**

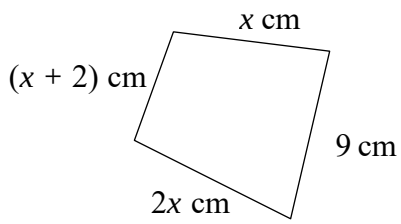
(ii) area of the label. **1**

(iii) volume of the can. **1**

(b) If $V = \dfrac{h}{2(r+h)}$, find h if $r = 8$ and $V = 0.1$ **2**

(c) Given that $A = \dfrac{Y}{B}$, find A when $Y = 300$ and $B = 3{\cdot}81 \times 10^{-4}$.
Express your answer in scientific notation correct to 2 significant figures. **2**

(d)



(i) Show that the perimeter P cm of this quadrilateral is given by **1**

$$P = 4x + 11$$

(ii) If the perimeter is 91 cm, determine the longest side length. **2**

Question 22 continued. **Marks**

(e) Given the radius of the Earth is approximately 6400 km, find the distance between the two points on the equator, (0^0, 20^0W) and (0^0,8^0E). (Give your answer to the nearest kilometre.) **2**

(f) Calculate the distance, in nautical miles, between (20^0N,85^0W) and (35^0N, 85^0W). **2**

(g) Given 1 M = 1.852 km, calculate the average speed, in knots for a journey of 865 km in 6 hours and 54 minutes. (Give your answer to the nearest knot.) **2**

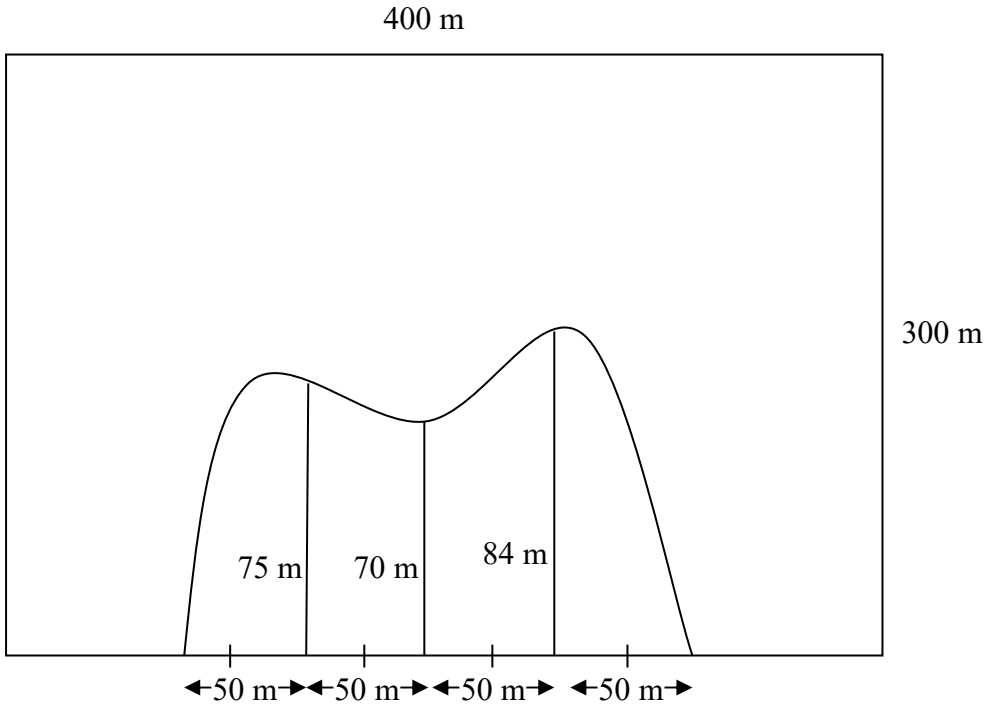
(h) Ruby needs to have a sum of $5 000 in 3 years. She invests in an annuity that earns 5.4% p.a compounding quarterly. How much should she deposit each quarter to achieve her required sum? **3**

End of Question 22

Marks

Question 23 (20 marks) Use a SEPARATE answer booklet.

(a) A rectangular shaped park with dimensions 400 m by 300 m has a lake within its boundaries with dimensions as illustrated in the diagram. (Diagram not to scale.)



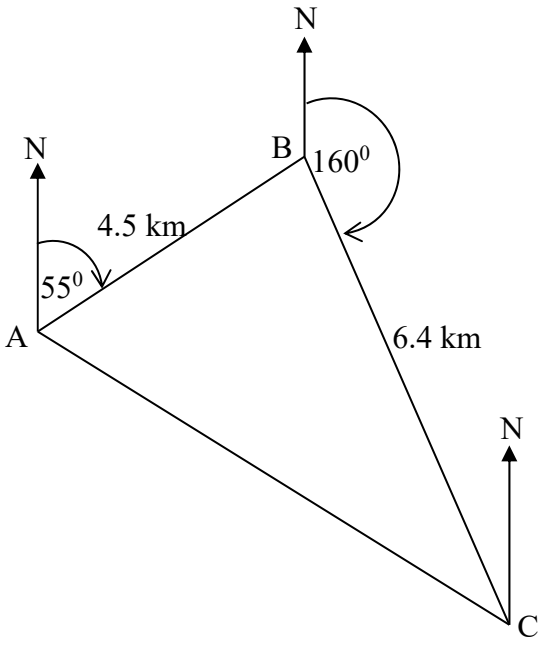
(i) Using Simpsons rule twice calculate the area of the lake to the nearest 10 square metres. **2**

(ii) If the lake has an average depth of 1.5 m, calculate the amount of water in the lake in Kilolitres **2**

(iii) What percentage of the park is occupied by the lake. Answer to 1 decimal place. **2**

Question 23 Continued. **Marks**

(b) The diagram below represents a sailing course.



(i) Show that ∠ABC = 75°. **1**

(ii) Find the distance AC to one decimal place. **3**

(iii) Find ∠BAC to the nearest degree. **2**

(iv) Find the bearing of A from C. **1**

(c) A home loan of $350 000 is taken out and repaid monthly over 25 years.

(i) Determine the monthly repayment if interest is calculated at 8.4% p.a. **3**

(ii) Determine the total amount repaid. **1**

(iii) Determine the amount saved on the loan if repayments are made fortnightly at a rate of 7.8% p.a. over 25 years. **3**

END OF PAPER

Section I – Multiple Choice

Answer sheet

	A	B	C	D
1				
2				
3				
4				
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8				
9				
10				
11				
12				
13				
14				
15				
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17				
18				
19				
20				

Q21

(19)

$$\frac{4.8 \times 10^5}{6.4 \times 10^{-2}}$$

M = 7500000
= 7.5×10^6 ✓

b) $4(2y-2) = 5y+19$
$8y-8 = 5y+19$ ✓
a $3y = 27$
$y = 9$ ✓

c i) $A = P(1-r)^n$ ✓
Value $= 5800(1-0.3)^3$ ✓
= $1989.40

F ii) Straight Line Value $= 5800 - 1200 \times 3$ ✓
= $2200
∴ Straight line method gives greater value

d i) $\angle BAC = 3^\circ$ ✓

N ii) $\frac{a}{\sin A} = \frac{b}{\sin B}$
$\frac{AC}{\sin 18} = \frac{50}{\sin 3}$ ✓
$AC = \frac{50}{\sin 3} \times \sin 18$

$AC = 295.22\ldots$ (Calc)
∴ AC = 295 m ✓

iii) $\sin\theta = \frac{O}{H}$
$\sin 21^\circ = \frac{AD}{295}$ ✓
M $AD = 295 \times \sin 21$
$= 105.71\ldots$ (Calc)
= 106 m ✓

e i) Fencing required (207.4095m)
= 204 – 212 ✓
M $72+47+43+46 = 208$m
One mark for adding 4 sides ✓

ii) Area $= \frac{1}{2}y$ 70×95
= 2520 m² ✓✓
2520

∴ No of Trees $= 2520 \div 12$
= 210 Trees ✓

f) Time Difference $= 100 \times 4$
M = 400 mins ✓
= 6h 40 mins
Time in Rome = 6h 40 + 5h 30 + 8 a.m ✓
= 8.10 p.m (same day)

Q22

a) i) $C = \pi d$

$= \pi \times 6.5\text{ cm}$

$= 20.42035225$ 1

$= 20.4\text{ cm}$ 1

ii) $A = 2\pi rh$

$= 20.4 \times 11$

$= 224.4\text{ cm}^2$ 1

OR 224.6 cm^2

iii) $V = \pi r^2 h$

$= \pi \times (3.25)^2 \times 11$

$= 365.0137964$ 1

$= 365.0\text{ cm}^3$

b) $V = \frac{h}{2(r+h)}$

$\therefore 0.1 = \frac{h}{2(8+h)}$ 1

$0.2(8+h) = h$

$1.6 + 0.2h = h$

$0.8h = 1.6$

$h = 2$ 1

c) $A = \frac{Y}{B}$

$A = 300 \div (3.81 \times 10^{-4})$

$A = 787401.5748$ 1

$A = 790000$ (2 sig figs)

$A = 7.9 \times 10^5$ 1

d) i) $P = x + 9 + 2x + (x+2)$ 1

$= 4x + 11$

ii) $91 = 4x + 11$

$4x = 80$

$x = 20$ 1

$\therefore$ Longest side $= 2(20) = 40\text{cm}$

e) Angular Diff $= 20^\circ + 8^\circ$

$= 28^\circ$ 1

$\therefore$ Distance $= \frac{28^\circ}{360^\circ} \times 2 \times \pi \times 6400$

$= 3127.63002$

$= 3127.63\text{ km}$ 1

f) Angular Diff $= 35^\circ - 20^\circ$

$= 15^\circ$ 1

$\therefore$ Distance $= 15 \times 60$

$= 900$ nautical miles 1

g) $865\text{ km} = 865 \div 1.852$

$= 467.062635$ naut. miles 1

$\therefore$ Average Speed $= 467.062635 \div 6\text{hours } 54\text{min}$

$= 67.69023695$

$= 68$ knots 1

h) $n = 12$

$I = 1.35$ $\therefore PMT = \$386.63$ 1

$PV = 0$

$PMT = 0$ 2

$FV = 5000$

$P/Y = 1$

$C/Y = 1$

$A = \frac{M[(1+r)^n - 1]}{r}$ OR

$5000 = \frac{M[(1+0.0135)^{12} - 1]}{0.0135}$ 1

$M = \frac{5000 \times 0.0135}{(1+0.0135)^{12} - 1}$ 1

$\therefore$ Payment $= \$386.63$ 1

Q23

a) Area $\doteq \frac{h}{3}\{d_f + 4d_m + d_l\}$

$\doteq \frac{50}{3}\{0 + 4\times 75 + 70 + 70 + 4\times 84 + 0\}$ OR 2 Sep. Areas

$\doteq \frac{50}{3} \times 776$ or $\frac{50}{3}\times 370 + \frac{50}{3}\times 406$

$\doteq 12933.3\ldots$ (calc)

$= 12930\ m^2$

ii) Volume $= A \times h$

$= 12930 \times 1.5$

$= 19395\ m^3$

$= 19395\ KL$

iii) % Lake Occupies $= \frac{12930}{(400\times 300)} \times 100$

$= \frac{12930}{120000} \times 100$

$= 10.775$

$= 10.8\%$

bi) $\angle ABC + 160 + (180 - 55) = 360$

$\angle ABC + 160 + 125 = 360$

$\therefore \angle ABC = 75^\circ$

Q23

(i) $a^2 = b^2 + c^2 - 2bc\cos A$

$AC^2 = 4.5^2 + 6.4^2 - 2\times 4.5\times 6.4\cos 75^\circ$

$= 46.302\ldots$ (Calc)

$\therefore AC = 6.804\ldots$ (Calc)

$= 6.8$ cm

(ii) $\frac{\sin A}{a} = \frac{\sin B}{b}$

$\frac{\sin A}{6.4} = \frac{\sin 75}{6.8}$

$\sin A = \frac{\sin 75}{6.8} \times 6.4$

$= 0.9091\ldots$ (Calc)

$\angle BAC = \sin^{-1}(0.9091\ldots)$

$= 65.38\ldots$

$= 65^\circ$

(iii) Bearing of A from C $= 360 - 40 - 20$

$= 300^\circ T$

c) $N = M\left[\frac{(1+r)^n - 1}{r(1+r)^n}\right]$

$350000 = M\left[\frac{(1+0.007)^{300} - 1}{0.007(1+0.007)^{300}}\right]$

$350000 = M\left[\frac{1.007^{300} - 1}{0.007\times 1.007^{300}}\right]$

By Graphics

$n = 300$

$I = 8.4$

$PV = 350000$

$FV = 0$

$P/Y = 12$

$C/Y = 12$

$PMT = 2794.74$

$\therefore M = 350000\times 0.007\times 1.007^{300} \div \left[1.007^{300} - 1\right]$

$= 2794.747\ldots$ (Calc)

$\therefore$ Monthly Payment $= \$2794.75$

(ii) Total Repaid $= 2794.75\times 300$

$= \$838425$

(iii) Using $r = 7.8 \div 26 \div 100$

$= 0.003$

and $n = 26\times 25$

$= 650$

$n = 650$

$I = 7.8$

$PV = 350000$

$FV = 0$

$P/Y = 26$

$C/Y = 26$

$M = 350000\times 0.003\times 1.003^{650} \div \left[1.003^{650} - 1\right]$

$= 1224.761\ldots$ (Calc)

Fortnightly Payments $= \$1224.76$

Amount Saved $= \left[(2794.75\times 12) - (1224.76\times 26)\right]\times 25$

$= \left[33537 - 31843.76\right]\times 25$

$= 1693.24\times 25$

$= \$42331$