GENERAL MATHEMATICS

MOUNT SAINT JOSEPH

Half yearly Examination 2005

Time Allowed: 2 hours
plus 5 minutes reading time

Instructions to Students

- Write using black or blue pen
- Calculators may be used
- A formulae sheet is provided
- Write your student number on each page

Total Marks - 80

Section 1
15 marks
- Attempt all questions.
- Answer on the Multiple Answer sheet provided.

Section 2
65 marks
- Attempt all questions
- Answer each question on a new page
- Show all necessary working
- Marks may be deducted for careless or poorly arranged work
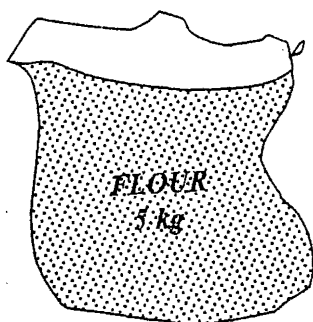
Section I

Total Marks (15)
Attempt Questions 1 – 15
Allow about 20 minutes for this section

Use the multiple choice answer sheet provided.

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1. When 35% of the flour in the 5kg bag is used, what weight remains?

   (A)   175g
   (B)   650g
   (C)   1·75kg
   (D)   3·25kg

2. Which of the following is **not** equivalent to $12p^2$?

   (A) $\dfrac{24p^2}{2}$

   (B) $8p^2 + 5p^2 - p^2$

   (C) $(6p)^2$

   (D) $3p \times 4p$

3. The simplification of $5(x-3) - 2(x-4)$ is

   (A) $3x - 2$
   (B) $3x - 7$
   (C) $7x - 23$
   (D) $7x - 7$

4. A car is travelling at a constant speed of 90km/h. How far will it travel in 45 minutes?

      (A)   4·05 km
      (B)   2 km
      (C)   60km
      (D)   67·5 km

5. To estimate the number of feral cats in a national park, rangers catch 15, tag them and then release them.
A few days later they again catch 15 cats and note that only 3 of these were tagged.
What would be the estimate of the number of cats in the park?

      (A)   60
      (B)   90
      (C)   45
      (D)   75

6. A bag contains three times as many red marbles as blue marbles. If one marble is selected at random, the probability that it will be a blue marble is:

      (A) $\dfrac{1}{2}$

      (B) $\dfrac{2}{3}$

      (C) $\dfrac{1}{3}$

      (D) $\dfrac{1}{4}$

7. A recipe for 12 muffins uses 4 cups of flour and 3 cups of sugar. A chef wants to make 150 muffins for a café. She would use :

      (A)   50 cups of flour and 30 cups of sugar
      (B)   72 cups of flour and 54 cups of sugar
      (C)   40 cups of flour and 30 cups of sugar
      (D)   50 cups of flour and 37·5 cups of sugar

8. The radar chart shows the number of males and females in a convenience store at different times of the day.

Numbers in a Convenience Store
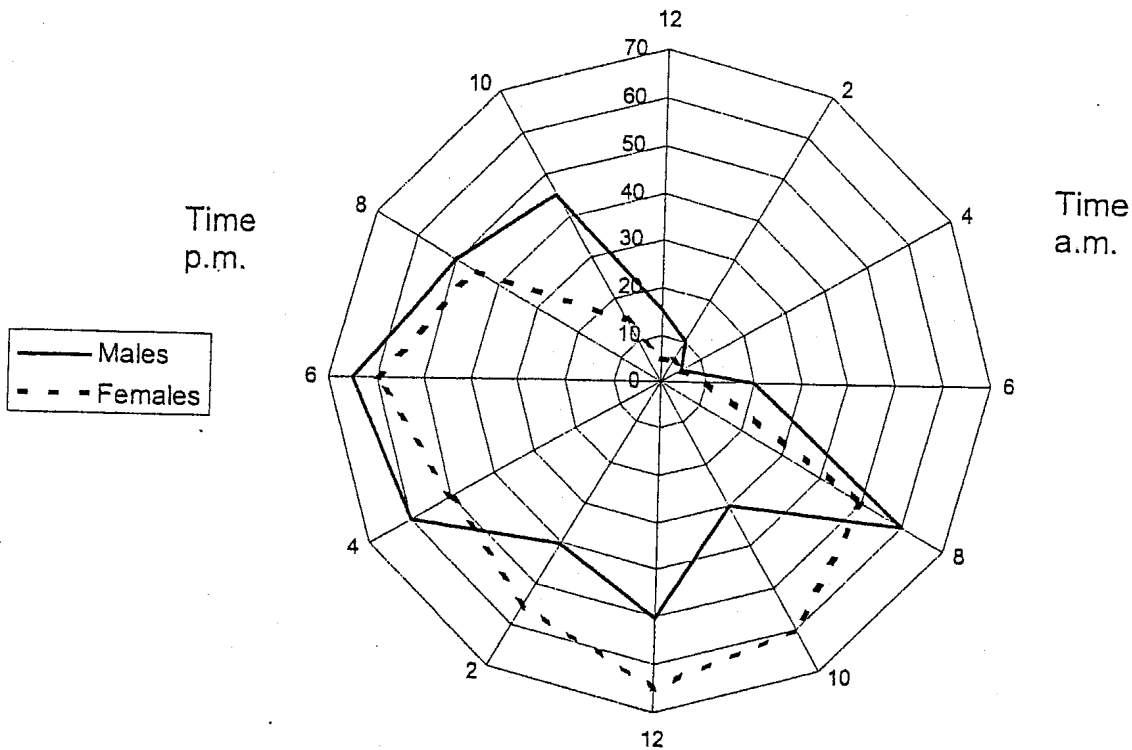
The time when the number of females was twice the number of males was :

(A)   6 a.m.
(B)   10 p.m.
(C)   10 a.m.
(D)   12 midday

9. Homer invests $5 000 for his daughter Lisa in a deposit which pays interest at 6% p.a. compounding annually. After the money has been invested for 3 years, the total interest earned (to the nearest dollar) is :

(A) $900
(B) $955
(C) $5 955
(D) $1 710 000

10. The graph below shows the comparison of wages for men (curve Q) and women (curve P), in a large company.

Wages of Men and Women
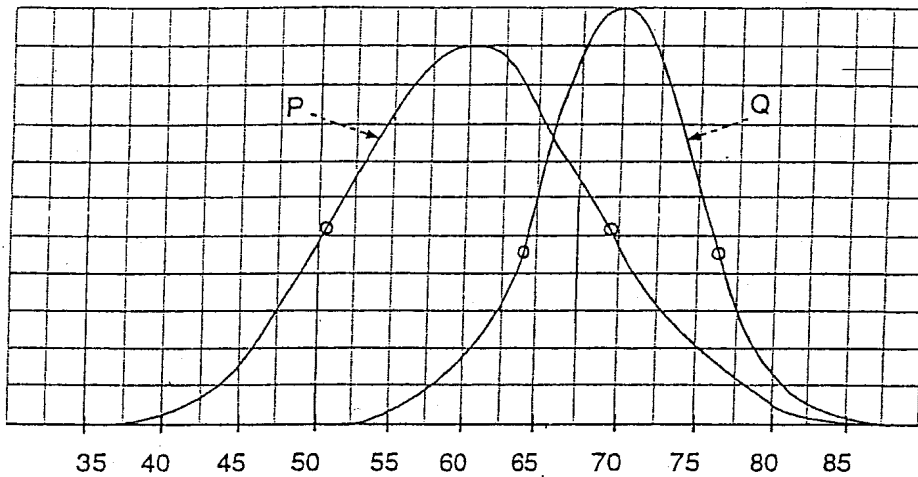
Thousands of dollars

In relation to women's wages (P), men's wages (Q) have :

(A) a greater standard deviation
(B) a smaller median
(C) a higher mode
(D) a smaller mean

11. Archie bought a $4 800 computer on the following terms. He paid a 25% deposit followed by 24 monthly repayments of $180.50. The amount of interest he paid was :

(A) $4 332.00
(B) $468.00
(C) $732.00
(D) $1 083.00

12. Debbie has a credit card on which no interest is charged for purchases made during the month until the due date. After this a rate of 0.0437% per day applies on the outstanding balance for each day after the due date.

A section of Debbie's statement for the month of July is shown below.

Opening Balance : $0.00

Date	Details	Amount
12/07/01	SGIO Insurance	$215.00
15/07/01	Ticket sales	$180.00
23/07/01	Eve Dress shop	$50.00
25/07/01	Snippets Hair Design	$45.00

Due Date   14/08/01   Daily percentage rate 0.0437%

If Debbie pays her account in full on 20/8/01 how much interest will be charged to her account?

(A) $21.41
(B) $1.28
(C) $3.00
(D) $0.56

13. A rectangular park has paths around its perimeter and one across its diagonal. Simon and Kim walk from X to Z. Simon goes directly along the centre path while Kim walks via corner Y.
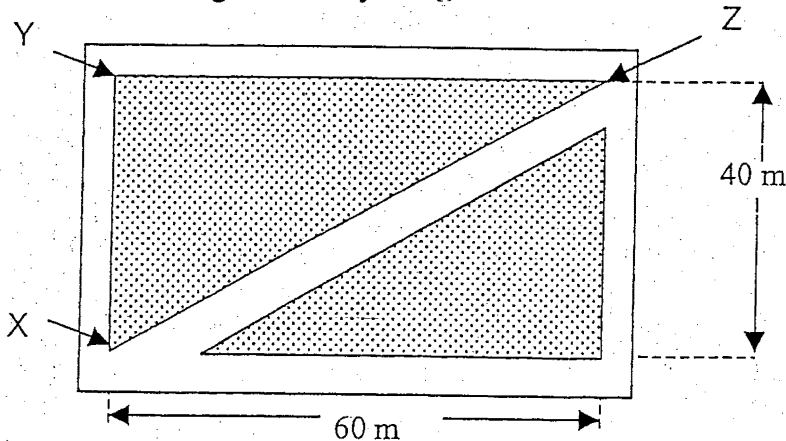
To the nearest metre the extra distance that Kim walks is :

(A)   20m
(B)   55m
(C)   72m
(D)   28m

14. The 15 cm label is to be attached to the can by a machine in the factory so that it completely fits around the can with no overlap.
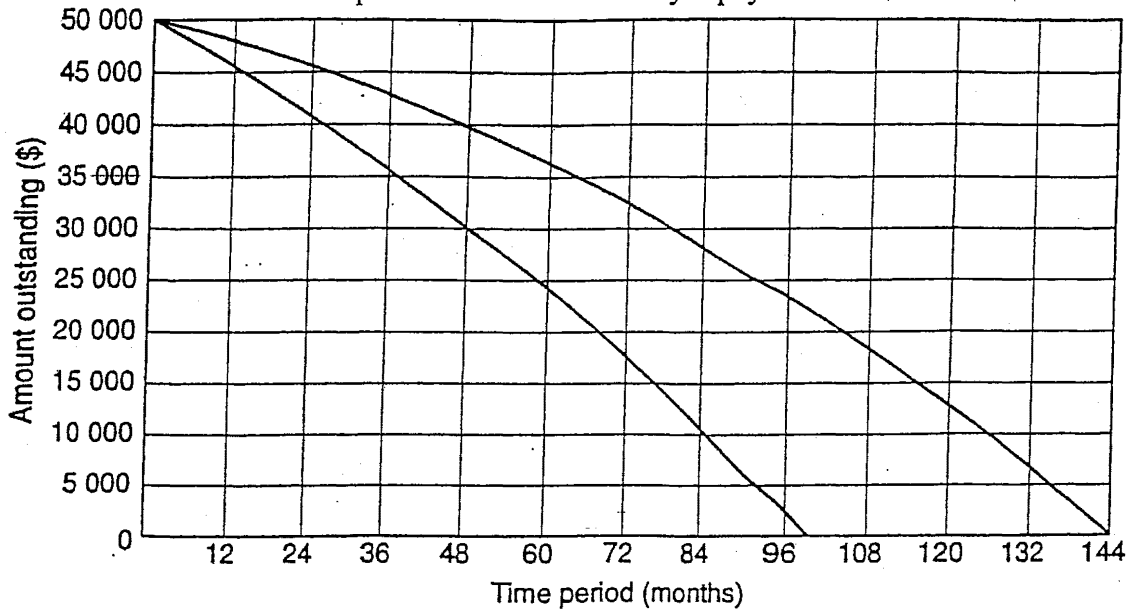

← — 15 cm — →

Golden Prism
Crushed Pineapple
450 g
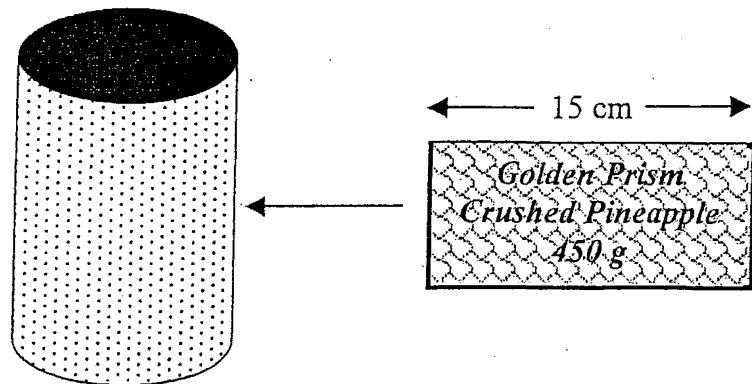
The radius of each of the cans is approximately :

(A)   7·5 cm
(B)   6 cm
(C)   4·8 cm
(D)   2·4 cm

15. The following graphs show the amount remaining on a loan of $50 000 after regular monthly payments have been made over a period of 144 months.

The curves show the comparison between monthly repayments of $600 and $750.

Time period (months)

After 4 years of regular monthly repayments of $600, the total amount of interest that has been paid is approximately :

(A) $30 000
(B) $20 000
(C) $18 000
(D) $10 000

Section II

Total Marks (65)
Attempt Questions 16-20
Allow about 1 hour and 40 minutes for this section.

Answer each question starting on a new page

Question 16   (13 marks)   Start a new page.

(a)   Solve the equation

$$6(2-3w) = 2w+2$$

2

(b)   On his way to work Leonardo passes three lots of roadwork. At the first
section of roadwork the traffic is regularly stopped for 20% of the time
and at the second and third sections it is regularly stopped for 10% of
the time.

(i)   Copy and complete the probability tree diagram below to show
the possible outcomes for Leonardo passing through the three
sections of roadwork.

2

1ˢᵗ Section   2ⁿᵈ Section   3ʳᵈ Section

0.2   Stopped

0.8   Not Stopped
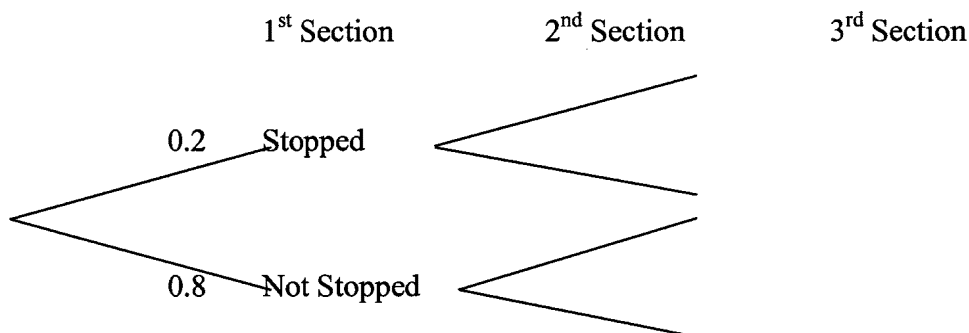
(ii)   What is the probability that he travels to work without being
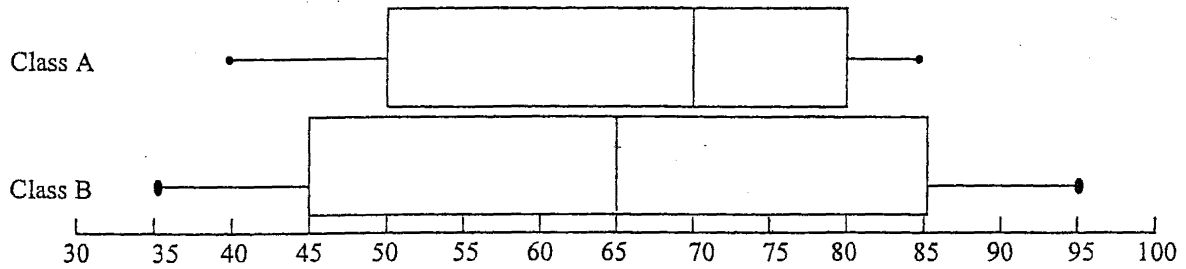stoped by roadwork?

1

(iii) What is the probability that he is stopped at least once for
roadwork?

1

(iv)   What is the probability that he is stopped exactly once for
roadwork?

2

Question 16 (continued)

(c)   The box and whisker plots below, compare the marks of students in two classes.

(i)   What is the lowest mark in class A?   1

(ii)   What is the median for class B?   1

(iii)   What is the range of class B?   1

(iv)   What is the interquartile range of class A?   1

(v)   Compare the skew of the two classes results.   1

Question 17 (13 marks) Start a new page.

(a) The area chart below shows the changing pattern of the way savings were used in the years 1998-2002.

Savings Pattern 1998-2002
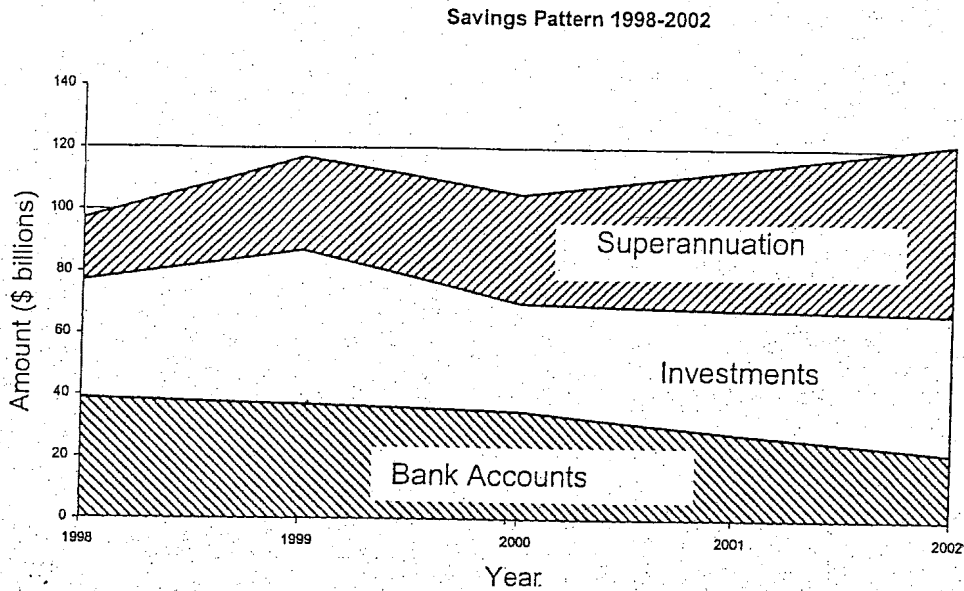
(i) In which years were investments at their highest level? 1

(ii) In which year were the categories equal proportions of the total? 1

(iii) In which year were the total of the three categories at their lowest? 1

(iv) What is the trend for superannuation from 1998-2002? 1

(b) A formula for Energy is $E = \frac{1}{2}mv^2$

(i) Find the value of E when $m = 20$ and $v = -3$ 1

(ii) Find the value of m when $E = 20$ and $v = 4$. 1

(iii) Make v the subject of the formula. 2

Question 17 (continued)

(c)   A company logo, shown below, consists of an ellipse and a circle.
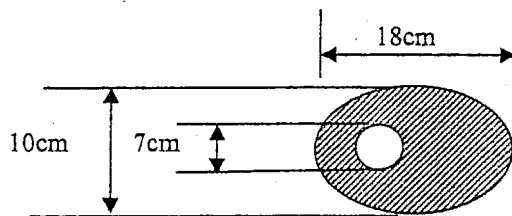
(i)   Calculate the shaded area of the logo correct to
        3 significant figures.   **3**

(ii)   A solid shape with the above cross-section and a thickness
        of 3cm is made from timber. Find its volume.   **1**

(iii)   If the timber used in (ii) has a density of $0.85g/cm^3$,
        what is the mass of the above solid? (nearest gram)   **1**

Question 18 (13 marks)   Start a new page

(a)   An ancient Greek building called a *Tholos* consisted of a cylinder surmounted by a hemispherical dome.
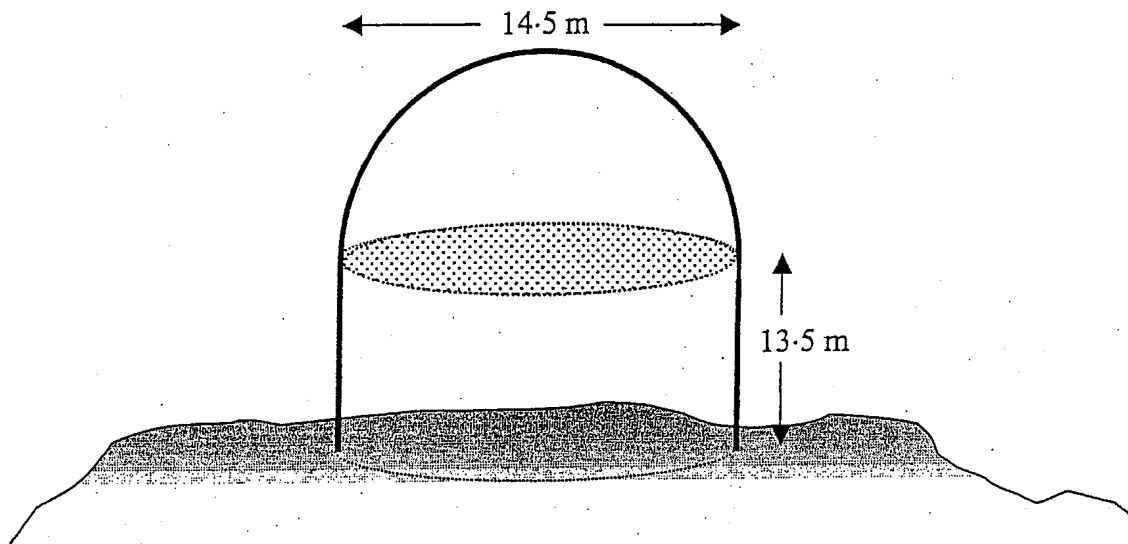
The diagram shows a typical tholos with diameter 14.5 metres.
The height of the lower cylindrical section is 13.5 metres.

(i)   Write down the radius of the tholos.   1

(ii)   Determine the perpendicular height of the building above
        ground level.   1

(iii)   Determine the volume of the hemispherical dome.   2

(iv)   Determine the volume of the building.   2

Question 18 (continued)

(b) Fossil samples from two different archaeological sites have been collected and their weights recorded in grams in the back-to-back stem and leaf plot shown below.

Weights of fossil samples (g)											
Site A						Site B					
					1	4					
				8	2	0	1	4	6		
		8	6	2	3	2	3	4	5	6	
	9	7	6	6	4	3	4	4	5	7	
9	9	8	6	4	5	2	6	7			
	8	6	4	1	6	1					
		2	1	0	7						

(i) The five figure summary for fossils collected at site A is shown below.

Fossil Samples	Site A	Site B
Minimum weight	28	
Lower Quartile	46	
Median	57	
Upper Quartile	65	
Maximum weight	72	

Using the data in the stem and leaf plot, write down the five figure summary for the weights of the fossil samples collected from site B. **4**

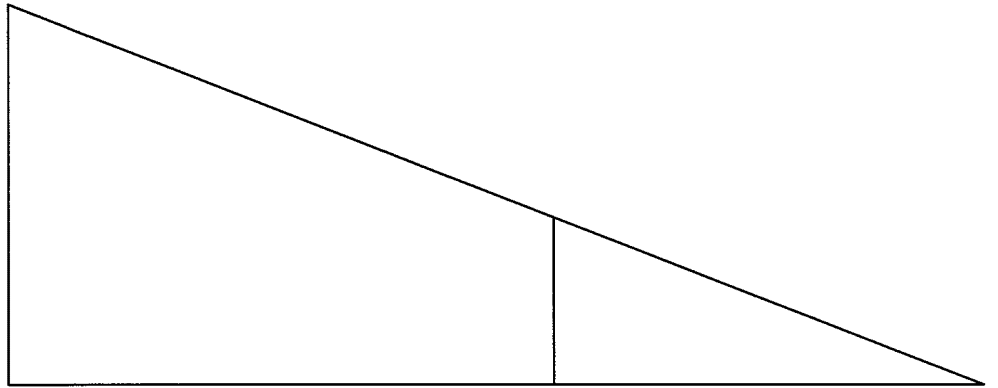(ii) Compare and contrast the sample fossil weights from the two sites. **3**

Question 19 (13 marks)   Start a new page

(a)   A street light on a pole is 15metres above the ground. A person, standing nearby, who is 1.8 metres tall casts a shadow from the light which is 5.4 metres long.

    (i)   Copy the diagram below and label it to show the information given above.   **1**

    (ii)   Calculate the distance of this person from the base of the pole.   **2**

   (iii)   At what angle of elevation would the person look to focus directly on the light?   **2**

Question 19 (continued)

(b)   A trial was conducted on a medicine to help relieve indigestion. Some users reported side effects of headaches. The results are summarised in the table below.

	Indigestion	No Indigestion	Total
Headaches	12	24	36
No Headaches	15	69	84
Total	27	93	

(i)   How many people took part in the trial altogether?   **1**

(ii)   What percentage of those who took part in the trial reported side effects of headaches?   **1**

(iii)   If a person who took part in the trial was chosen at random, what is the probability that they suffered indigestion and headaches?   **1**

(c)
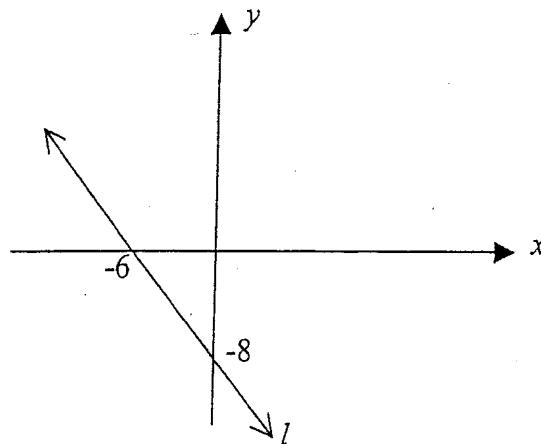
(i)   Find the gradient of the line *l* shown in the diagram.   **1**

(ii)   Write down the equation of line *l*.   **1**

Question 19   (continued)

(d)   The graph below shows the relationship between the speed of a car and the distance it takes to stop the car under maximum brakes (the stopping distance). The stopping distance is broken into two sections, the distance travelled before the brakes are applied, (the reaction distance) and the distance it takes the brakes to bring the car to a complete stop (the braking distance).

Stopping Distances for a Car at Various Speeds
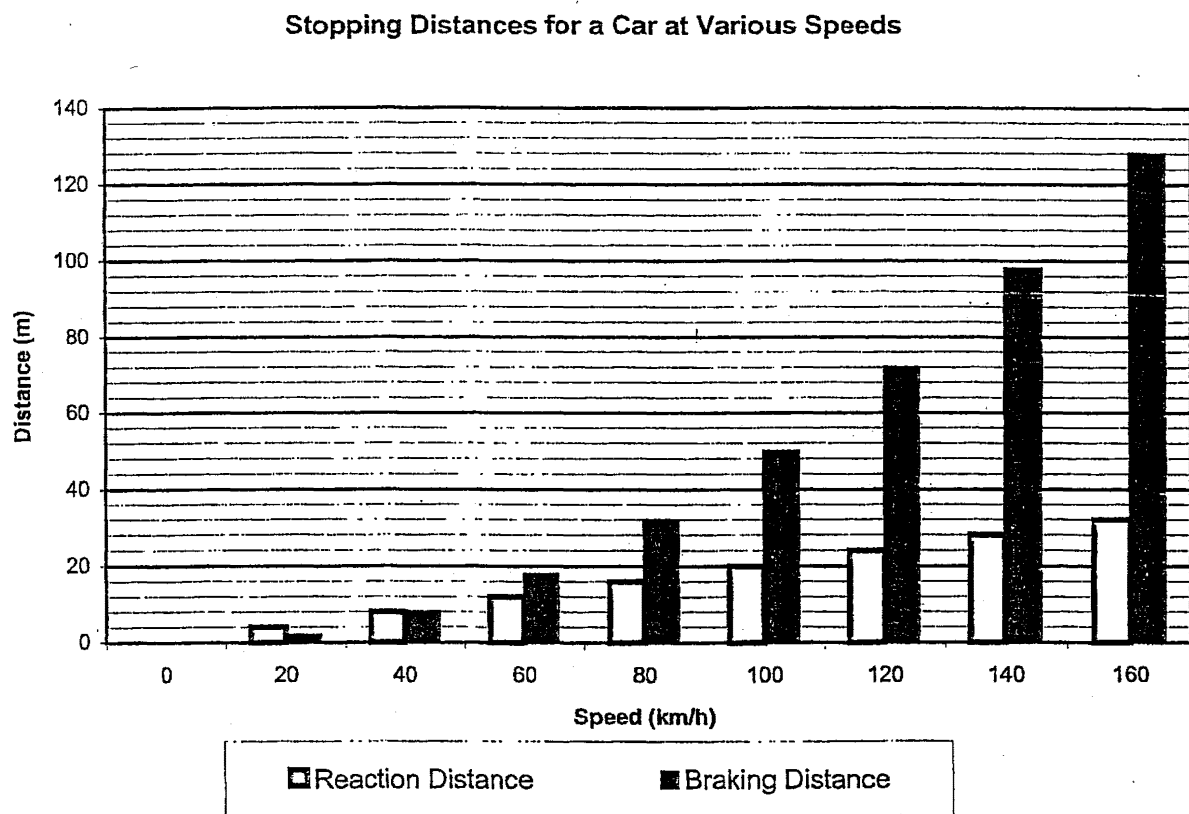
(i)   What is the braking distance when travelling at a speed of
        120 km/h?   1

(ii)   What is the total stopping distance (including reaction and
        braking) when travelling at a speed of 80 km/h?   1

(iii)   For what speed is the reaction distance greater than the
        braking distance?   1

Question 20 (13 marks)   Start a new page

(a)   Rod took out a $ 40 000 loan to buy a restored 1956 Chevy. He drew up a spreadsheet to show the progress of his loan repayments. The table below is produced from the spreadsheet.

Rod's Chevy Loan
Amount of Loan $40 000
Interest rate 9% p.a. compounded monthly.
Monthly Repayment $1 500

Month No	Amount Owing (P)	Interest (I)	Repayment (R)	P + I	P + I − R
1	40 000.00	300.00	1 500.00	40 300.00	38 800.00
2	38 800.00	291.00	1 500.00	39 091.00	37 591.00
3	37 591.00	281.93	1 500.00	37 872.93	36 372.93
4	36 372.93	A	1 500.00	B	C

Calculate the values that would appear in the table at the points   **3**
A, B and C.

(b)   Six friends Andrew, Blaise, Candy, Doug, Evan and Felicity are to sit side by side on the stage at a school assembly.

(i)   How many different arrangements are there of the six friends?   **1**

(ii)   Three of them are to stand up and hold the school banner. How many different combinations of the three are there if their position is not important?   **2**

Question 20 (continued)

(c) Sally and Peter have determined that they will need $ 130 000 to open a fashion boutique in 5 years time.

They plan to make regular monthly contributions of $ 2 000 into an investment account which pays interest at the rate of 6% pa compounded monthly.

(i) What is the monthly interest rate written as a decimal? 1

(ii) A financial advisor suggests to Sally and Peter that this investment strategy should allow them to exceed the amount they require by about $ 10 000. By calculation, explain whether the advice given to them is correct. 2

(iii) Determine the interest Sally and Peter will have earned on their investment. 2

(iv) How much would Sally and Peter have needed to invest in a lump sum now to have the required $ 130 000 in 5 years time? (Assume the interest rate is the same and paid monthly) 2

MULTIPLE CHOICE ANSWER SHEET
FOR PART A

Student Number:_____

Place a cross in the box which corresponds to the correct answer.

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D
14	A	B	C	D
15	A	B	C	D

1. D   3.25kg

2. C

3. $5(x-3) - 2(x-4)$

   $= 5x - 15 - 2x + 8$

   $= 3x - 7$ B

4. $\dfrac{3}{4} \times 90 = 67.5$ D

5. $\dfrac{3}{15} = \dfrac{15}{x}$ $x = 75$ D

6. D

7. D

8. C

9. $A = 5000 \times 1.06^3$

   $= 5955.08$

   Int $= 5955.08 - 5000 = \$955.08$ B

10. C

11. D = \$1200

    Rep $= 24 \times 180.50$

    $= 4332$

    Total $= 5332$

    Int $= \$732$ C

12. $6 \times .000437 \times 490 = \$1.28$ B

13. Kim $= 100$

    Simon $= \sqrt{60^2 + 40^2}$

    $= 72.11$

14. $2\pi r = 15$

    $r = \dfrac{15}{2\pi}$

    $= 2.38$ D

15. Rep $= 48 \times 600$

    $= 28800$

    Int $= 28800 - 10\,000$

    $= 18800$ C

Extra $= 28m$ D

(16) a) $6(2-3w) = 2w+2$

  $12 - 18w = 2w + 2$ ①

  $10 = 20w$

  $w = \frac{1}{2}$. ①

b)
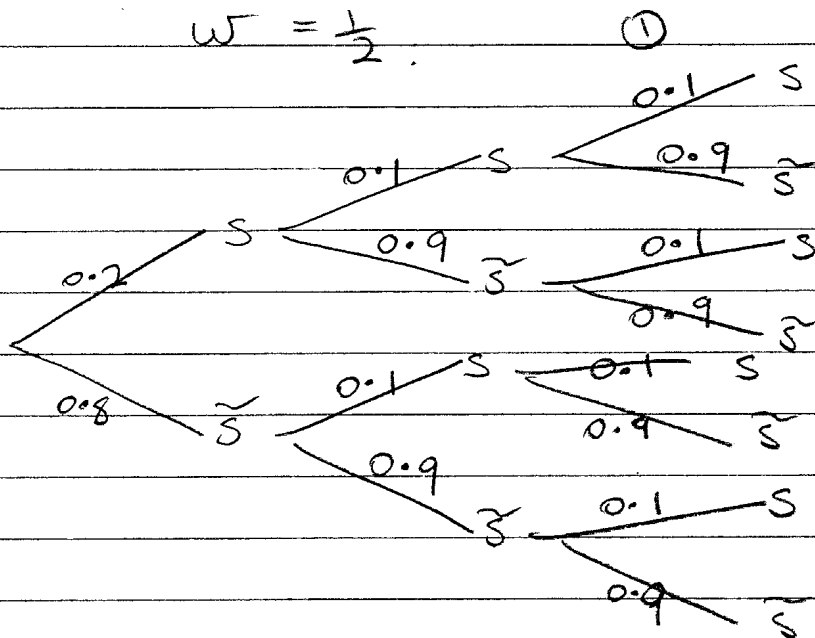
① mark for 2nd section

① mark for 3rd section

ii) $P(\tilde{S}\tilde{S}\tilde{S}) = 0.8 \times 0.9 \times 0.9$

  $= 0.648$. $\frac{81}{125}$ ①

iii) $P(\text{stopped at least once}) = 1 - P(\tilde{S}\tilde{S}\tilde{S})$

  $= 1 - 0.648$ $\frac{41}{125}$

  $= 0.352$ ①

iv) $P(S\tilde{S}\tilde{S}) + P(\tilde{S}S\tilde{S}) + P(\tilde{S}\tilde{S}S)$ ①

  $= 0.2 \times 0.9 \times 0.9 + 0.8 \times 0.1 \times 0.9 + 0.8 \times 0.9 \times 0$

  $= 0.306$ $\frac{153}{500}$ ①

c) i) 40 ①

  ii) 65 ①

  iii) $95 - 35 = 60$ ①

  iv) $80 - 50 = 30$ ①

  v) Class A is negatively skewed while ①
     Class B is symmetrical.

(17) a) i) 1999 ①
   ii) 2000 ①
   iii) 1998 ①
   iv) Superannuation is increasing ①

b) i) $E = \frac{1}{2}mv^2$ ii) $20 = \frac{1}{2} \times m \times 4^2$

   $= \frac{1}{2} \times 20 \times (-3)^2$ $20 = 8m$
   $= 90$ ① $m = 2.5.$ ①

iii) $2E = mv^2$
   $v^2 = \frac{2E}{m}$ ①
   $v = \pm\sqrt{\frac{2E}{m}}$ ①

c) i) $A = \pi \times 9 \times 5$ ① $- \pi \times 3.5^2$ ①
   $= 102.887\ldots$
   $= 103 \text{ cm}^2$ (3 sig fig) ①

ii) $V = Ah$ iii) $M = 309 \times 0.85$
   $= 103 \times 3$ $= 262.65$
   $= 309 \text{ cm}^3.$ ① $= 263 g$ ①

(18) a) i) $r = 14.5 \div 2$ ii) $h = 13.5 + 7.25$
   $= 7.25 m$ ① $= 20.75 m$ ①

iii) $V = \frac{4}{3}\pi r^3 \div 2$

   $= \frac{4}{3} \times \pi \times 7.25^3 \div 2$ ①

   $= 1596.2543\ldots \div 2$
   $= 798.12815\ldots$ ① $= 798.1 \text{ m}^3$ (1 dec pl

iv) $V_{cylinder} = \pi r^2 h$

$\qquad = \pi \times 7.25^2 \times 13.5$

$\qquad = 2229.2545\ldots$ ①

Total $V = 3027.3826\ldots$ ①

$\qquad = 3027.4 \, m^3$ (1 dec pl)

b) Min weight $= 14$
Lower Q $= 26$ ④ marks – 1 each error
Median $= 36$
Upper Q $= 47$
Max weight $= 61$

iii) Measure of Location is (57) quite different with Median for Site A being much higher than Median for site B (36)   ①

Both sites have a similar spread as indicated by Range for Site A (44) being Similar to Range for site B (47) and IQR for A (19) also being very similar to IQR for B (21)

① for noting similar spread
① for supporting this with numerical evidence for either range or IQR.

(19) i)
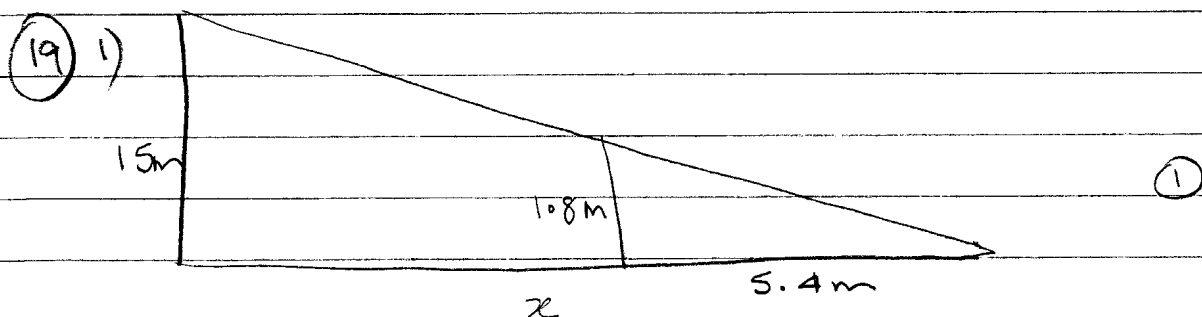
ii) $\dfrac{x}{15} = \dfrac{5.4}{1.8}$ ① $x = 45$

$\therefore$ Dist $= 45 - 5.4 = 39.6 m$ ①

iii)

15m, 45m, θ
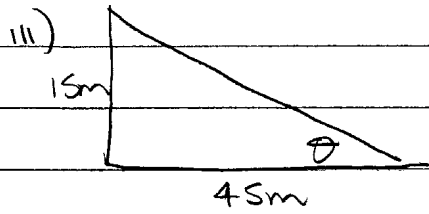
$\tan\theta = \dfrac{15}{45}$ ① $\dfrac{1.8}{5.4}$

$\theta = 18.4349\ldots$ ①

$= 18°$ (nearest deg).

(19 b) i) 120   ①

ii) $\dfrac{36}{120} \times 100 = 30\%$ ①

iii) $\dfrac{12}{120} = \dfrac{1}{10}$ ①

c) i) $m = \dfrac{-8}{6}$ ii) $y = -\dfrac{4}{3}x - 8$.   ①

$= -\dfrac{4}{3}$ ①   (or use of incorrect m from i))

d) i) 72 m ①   ii) $32 + 16 = 48m$ ①   iii) 20 km/h ①

& A0

20 a) $A = .00075 \times 36372.93$

$= \$272.80$.   ①

$B = \$36645.73$.   ① $36372.93 + 272.80$

$C = \$35145.73$.   ① $36645.73 - 1500$

b) i) $6! = 720$ ①

ii) $\dfrac{6!}{3!\,3!} = \dfrac{6 \times 5 \times 4 \times \cancel{3 \times 2 \times 1}}{\cancel{3 \times 2 \times 1} \times \cancel{3 \times 2 \times 1}}$ ① for dividing by 3! once

$= 20$ ways.   ① for dividing by 3! twice

c) i) $r = \dfrac{0.06}{12}$

$= 0.005$ ①

ii) $m = 2000$ $\qquad N = m\left\{\dfrac{(1+r)^n - 1}{r}\right\}$

$r = 0.005$

$n = 5 \times 12$ $\qquad\qquad = 2000 \times \dfrac{1.005^{60} - 1}{.005}$

$\quad = 60$

$\qquad\qquad\qquad\qquad = \$139540.06$ ①

Advice is correct. They exceed the required amount by $\$9540.06$. ①

iii) $\text{Int} = 139540.06 - 60 \times 2000$ ①

$\qquad = \$19540.06$ ①

iv) $N = 130\,000$ $\qquad A = \dfrac{N}{(1+r)^n}$

$r = 0.005$

$n = 60$ $\qquad\qquad = \dfrac{130000}{1.005^{60}}$ ①

$\qquad\qquad\qquad = \$96378.39$ ①