MOUNT SAINT JOSEPH
MILPERRA

MOUNT SAINT JOSEPH

2003
HIGHER SCHOOL CERTIFICATE
HALF YEARLY EXAMINATION

General Mathematics

General Instructions

- Reading time – 5minutes

- Working time – 2 hours

- Board approved calculators may be used

- Write using black or blue pen

- Draw diagrams using pencil

- Write your student number and/or name at the top of every page

- A Formulae Sheet is provided at the back of this paper

- **If a question is not attempted, a page with your name and N/A must be submitted**

Section I -

Total marks (20)

Attempt questions 1-20 on **answer sheet provided**

Allow about 30 minutes for this SECTION

Section II -

Total marks (60)

Attempt questions 21-24 on **own paper**

Allow about 90 minutes for this SECTION

This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME: ....

SECTION 1 – 20 Marks *(allow about 30 minutes for this section)*
Attempt all questions
Mark your answer in blue or black pen on the separate answer sheet provided

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1. Simplify $(2mn^2)^4$

    (A) $2m^4n^6$ (B) $8mn^8$ (C) $8m^4n^8$ (D) $16m^4n^8$

2. Express 0.008635517 correct to 4 significant figures.

    (A) 0.008   (B) 0.0086   (C) 0.008635   (D) 0.008636

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3. The flag pole on the roof of Parliament House in Canberra is 81 m tall. A supporting wire runs from the top of the flagpole to a point 20 m from the base of the pole.

    How long is this supporting wire, to the nearest metre?

    (A) 61 metres   (B) 78 metres

    (C) 83 metres   (D) 101 metres

    NOT TO SCALE

    81 m

    Supporting wire

    20 m

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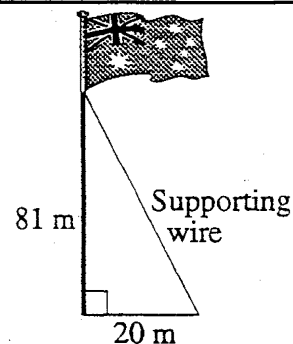
4. During the last month in the town of Billabong houses were sold for the following prices:

    | $160 000 | $145 000 | $175 000 | $200 000 |
    | $180 000 | $1 250 000 | $145 000 | $210 000 |

    Which measure gives the best idea of house prices in the area?

    (A) Mean
    (B) Median
    (C) Mode
    (D) Range

5. A Charity Raffle has 2000 tickets sold with three prizes being drawn. If Kerrie buys 10 tickets in the raffle, then her chance of winning all three prizes would be found by the calculation :

(A) $\dfrac{10}{2000} \times \dfrac{9}{1999} \times \dfrac{8}{1998}$

(B) $\dfrac{10}{2000} \times \dfrac{10}{2000} \times \dfrac{10}{2000}$

(C) $\dfrac{10}{2000} \times \dfrac{9}{2000} \times \dfrac{8}{2000}$

(D) $\dfrac{10}{2000} \times \dfrac{10}{1999} \times \dfrac{10}{1998}$

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6. Josephine has invested money for a rainy day in a long-term deposit. The account pays simple interest at the rate of 6%p.a. After the money was invested for 8 years, the total interest earned was $960. How much did she initially invest?
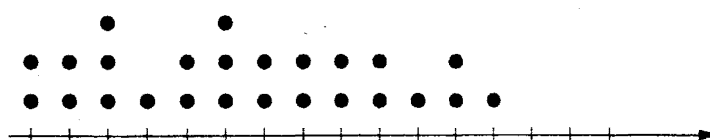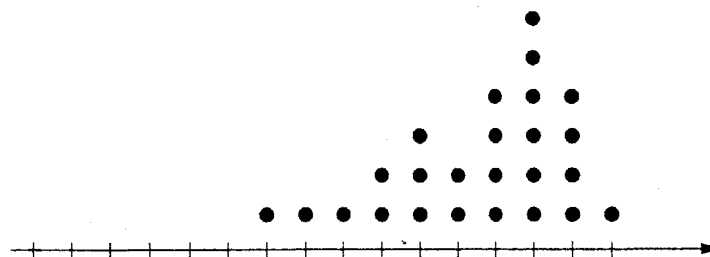
(A) $5 760

(B) $2 000

(C) $16 000

(D) $46 080

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7. The dot plots below are drawn on the same scale. They show the class scores in tests taken before and after a unit of work was completed.


Which statement about the change in scores is correct?

(A) The mean increased and the standard deviation decreased.

(B) The mean increased and the standard deviation increased.

(C) The mean decreased and the standard deviation decreased.

(D) The mean decreased and the standard deviation increased.

8. At Swan Bay High School, 20 students study HSC Geography and 20 students study HSC Biology. Their Trial HSC results in these subjects are shown in this double box-and-whisker plot.
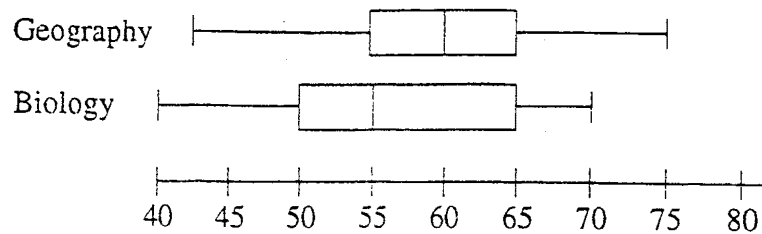
Which one of the following statements *must* be correct?

(A) More students scored above 65 in Geography than in Biology.

(B) In Biology, more students scored between 55 and 65 than between 50 and 55.

(C) The interquartile range for Geography is 5 more than the interquartile range for Biology.

(D) Fifteen geography students scored the same or more in Geography than the median mark in Biology.

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9. A new car is available with various options. The options are 6 paint colours, with or without air conditioning, with or without CD player and with or without cloth trim.

If the car dealer wanted to display all the options, how many cars would be needed?

(A) 9   (B) 12   (C) 18   (D) 48

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10. The table shows monthly repayments for various amounts borrowed, and different annual interest rates, for a term of 20 years.

Amount borrowed	Monthly repayment			
	5% p.a.	6% p.a.	7% p.a.	8% p.a.
$10 000	$66·00	$71·64	$77·53	$83·64
$15 000	$98·99	$107·46	$116·29	$125·47
$20 000	$131·99	$143·29	$155·06	$167·29
$25 000	$164·99	$179·11	$193·83	$209·11

If a loan for $15 000 is taken over 20 years at 6%p.a., calculate the total interest paid.

(A) $1289·52

(B) $2149·20

(C) $10 790·40

(D) $25 790·40

11. A spinner is made to decide the dessert for the evening. Find the probability that this evening we have custard or fruit.
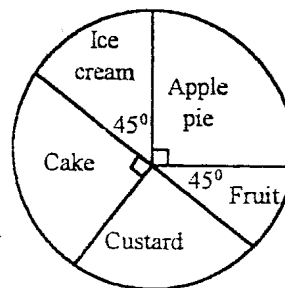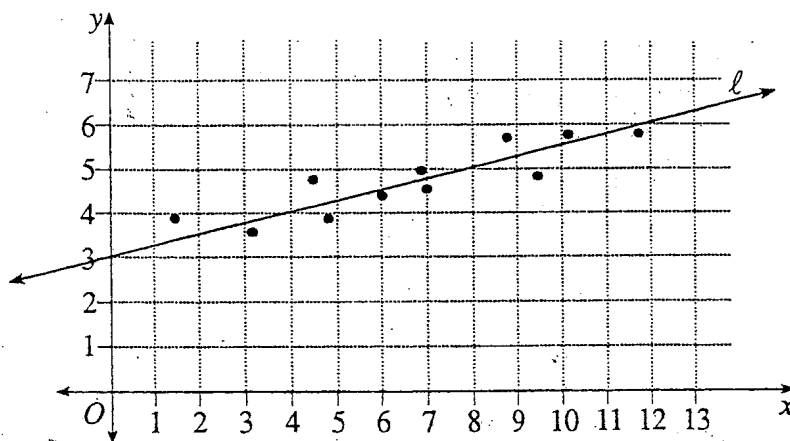

(A) $\dfrac{2}{5}$ (B) $\dfrac{3}{5}$ (C) $\dfrac{3}{8}$ (D) $\dfrac{2}{3}$

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12. A Visacard has an annual interest rate of 16%. What would be the equivalent DAILY interest rate to 3 significant figures?

(A) 0.000438%

(B) 0.0438%

(C) 0.044%

(D) 0.160%

13.

A line of fit, ℓ, is drawn through the points as shown.

What is the correct equation for line ℓ?

(A) $y = \dfrac{x}{4} + 3$ (C) $y = 4x - 12$

(B) $y = \dfrac{x}{4} - 3$ (D) $y = 4x + 3$

14. Pauline's percentage marks on ten geography tests over the year are shown below.

49, 43, 27, 43, 58, 72, 68, 29, 61, 52.

Pauline's friend Terry took the same tests. The standard deviation for his test marks was 6.5. Which student was the most consistent performer?

(A) Terry

(C) Both the same

(B) Pauline

(D) Neither

15. Kwon buys a packet of cashews weighing 375 grams measured correct to the nearest 5 grams.

Calculate the percentage error in this measurement, correct to the nearest 0.1%.

(A) 0.7

(C) 2.5

(B) 1.3

(D) 5.0

16. The fishing authorities are concerned about the number of fish in a certain lake. To investigate this they use the "capture-recapture" method. They capture 70 fish, tag them and release them. The following day they return and take a sample of 20 fish from the lake, noting that 3 of these are tagged.

Estimate the number of fish in the lake.

(A) 93

(C) 467

(B) 210

(D) 4 200

17. A triangle has its angles in the ratio of 1 : 2 : 3.
What is the difference between the largest and smallest angles ?

(A) 2°   (B) 30°   (C) 60°   (D) 90°

18. The formula $v^2 = u^2 + 2as$ has v^2 as it's subject. If it is re-written with u as the subject, it would become :

(A) $u = v - 2as$

(B) $u = 2as - v$

(C) $u = \sqrt{v^2 - 2as}$
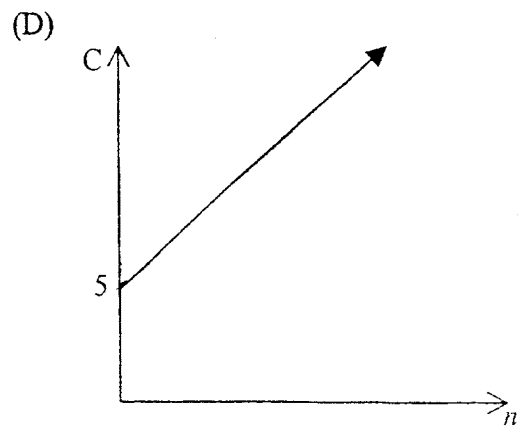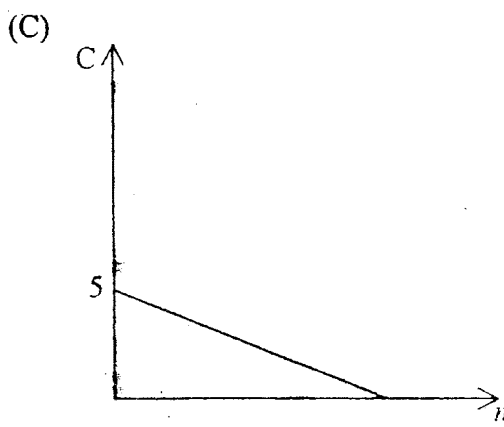
(D) $u = \sqrt{2as - v^2}$

19. This area graph shows the cost of advertising on Radio 2HN during three time intervals each day.

Cost of advertisements on Radio 2HN
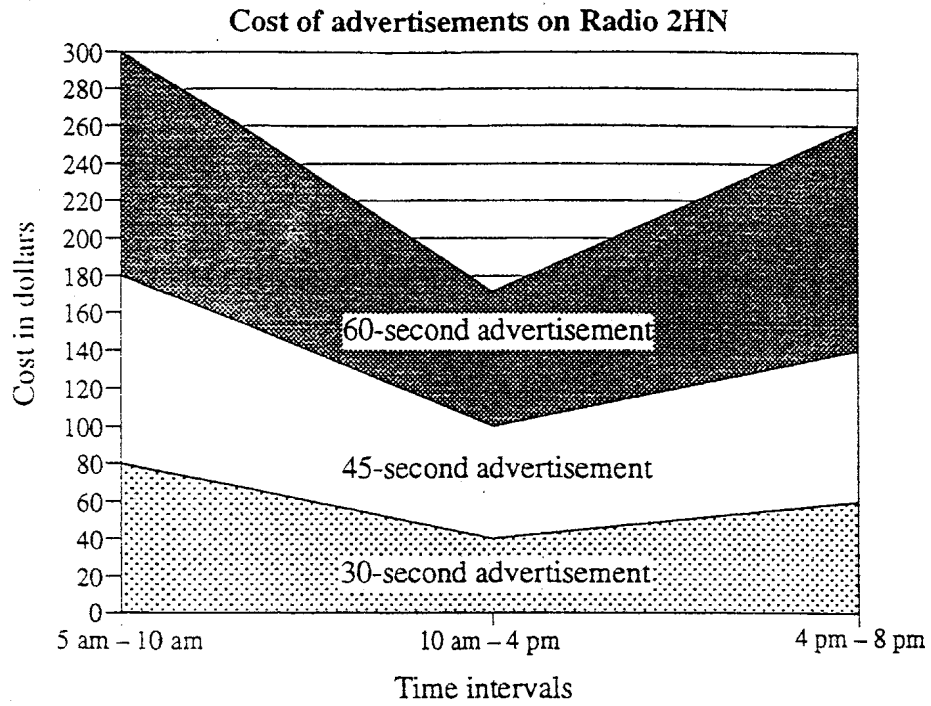
What is the cost of a 60-second advertisement between 10 am and 4 pm?

(A) $70   (B) $100   (C) $160   (D) $170

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20. The cost, C, of producing textbooks is given by the formula $C = 14n + 5$.

Which of the graphs drawn below best represents this equation?

(A)

(B)

(C)

(D)
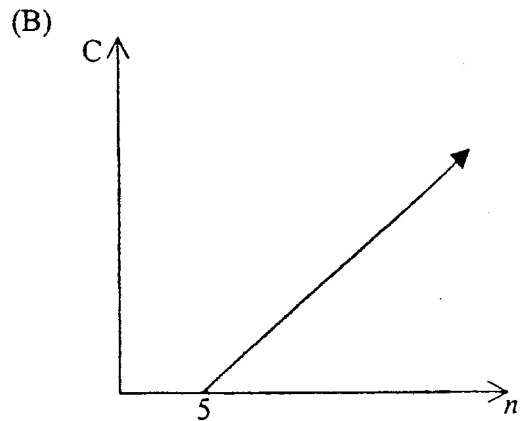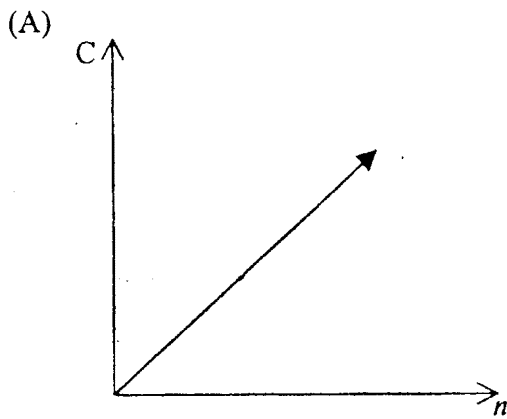
SECTION 2 – 60 Marks *(allow about 90 minutes for this section)*
- Attempt all questions
- Write your answer in blue or black pen on your own paper
- Start each question on a new page
- If a question is not attempted a page MUST be submitted with N/A on it

QUESTION 21 (15 marks)   *START A NEW PAGE*   *MARKS*

a)   Solve the equation $\sqrt{2x-1} = 3$ 2

b)   Rodney wishes to buy a large stainless steel barbecue priced at $ 1450. He chooses to
        buy it on terms by paying a 15% deposit and borrowing the balance. Interest is
        charged at 9.5% p.a. on the amount borrowed. Rodney makes fortnightly repayments
        over 2 years.

        i) How much deposit was paid on the barbeque?   1

        ii) Calculate the total amount Rodney has paid for the barbeque   2

        iii) Calculate his fortnightly repayments   2

c)   The sketch below shows the dimensions of a sunroom
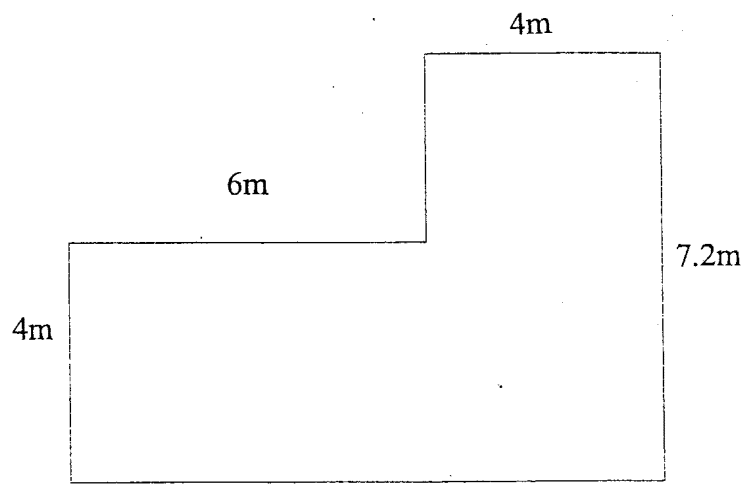
        i) Using a scale of 1cm = 1m , draw an accurate representation of the
            sunroom   1

ii) The sunroom is to be tiled with square tiles measuring 400mm x 400mm. How many tiles will be needed?　　**2**

d)　　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 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**

(iv)　If a person who took part in the trial was chosen at random, what is the probability that they suffered no indigestion ?　　**1**

e)　　James has six different-coloured pencils in his pencil case. He takes out two pencils without looking at their colours.

How many different combinations of colours are possible?　　**1**

QUESTION 22 (15 marks)   *START A NEW PAGE*   *MARKS*

a)   A building casts a shadow 5.2m. At the same time, a metre rule casts
       a shadow 0.65m long.
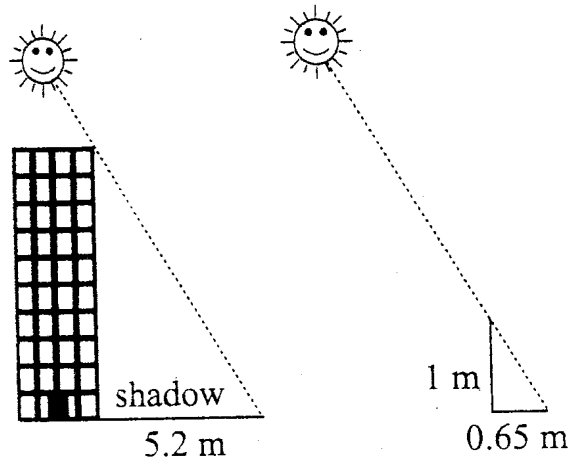
       i) Find the scale factor of the building   1

       ii) Hence or otherwise, find the height of the building   1

b)   The graph compares the progress of a $ 200 000 loan when repayments are made
       monthly and fortnightly.
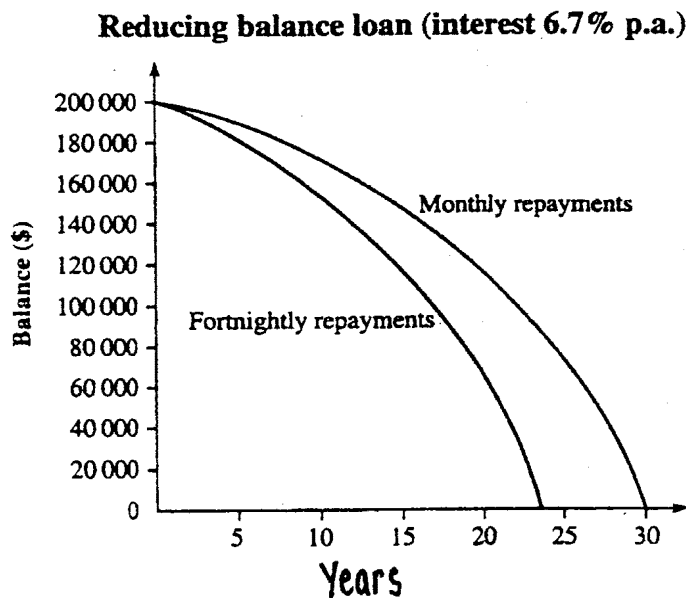
       (i)   Estimate the amount owing on the loan after 10 years if repayments are
              made monthly.   1

       (ii)   Estimate the number of years it takes to reduce the balance to $100 000   1
              if the repayments are made fortnightly.

       (iii) What are two benefits of paying fortnightly instead of monthly?   2

c)   At a day care centre, the number of words that each child can use is estimated and recorded. The age of each child is also recorded.

The graph provided on a separate page shows these results.

i)   Using the graph provided, draw the line of best fit through the plotted points   1

(ii)   Sally, who is three-and-a-half years old, was away from this day care centre on the day that this data was collected. Use your line of best fit to predict the number of words in Sally's vocabulary.   1

(iii)   From your graph, estimate at what age a child begins to use words.   1

(iv)   Use your graph to estimate the average rate at which the number of words increases per year.   1

(v)   Would you expect this trend to continue as the child progresses into adulthood. Justify your answer.   2

d)   Mrs Swan needs to give her daughter some medicine. Her daughter is 7 years old and weighs 22·5 kg. She is using the rule   3

$D = \dfrac{kA}{70}$ (where k is the mass of the child in kilograms and A is the adult dosage)

to calculate the dose of medicine for her daughter. The adult dosage is 12 mL every morning and 12 mL every night.

How many days will a 375 mL bottle of this medicine last her daughter?

QUESTION 23 (15 marks)   *START A NEW PAGE*   *MARKS*

a) George knows that his 4-digit PIN contains the digits 3, 5, 6, 7.

   (i)   How many different PINs are there using these four digits?   1

   (ii)   He remembers that the first digit is 7. What is the probability that his PIN is 7356?   2

b) If N is the number of years required for an investment to triple at 8% p.a., annually compounding interest, then $1.08^N = 3$.

   (i)   Find the value of 1.08^N when N equals 9·1.   1

   (ii)   Using the guess, check and refine method, find a value of N
        (to one decimal place) so that $1.08^N = 3$.   2

c) Mark has a 55-day interest free credit card. With this card, interest is charged on any outstanding balance after the due date. Interest is calculated at a rate of 0.0437% per day on any outstanding balance.

The July statement for Mark's card is shown below

Opening Balance : $0.00		
Date	Details	Amount
12/07/01	SGIO Insurance	$215.00
15/08/01	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%

Mark pays his account in full on the 22/8/01. Calculate the amount of interest that he will be charged to his account.   2

d) The following Home Loan Table shows Megan and Gary's home loan repayments over a 6-month period.

HOME LOAN TABLE

Amount = $80 000			This table assumes the same number of days in each month, that is: Interest = rate/12 × principal	
Annual interest rate = 10%				
Monthly repayment (R) = $800				
N	Principal (P)	Interest (I)	P + I	P + I − R
1	$80 000·00	$666.67	$80 666.67	$79 866.67
2	$79 866.67	$665.56	$80 532.23	$79 732.23
3	$79 732.23	B	C	D
4	$79 596.67	$663.31	$80 259.98	$79 459.98
5	$79 459.98	$662.17	$80 122.15	$79 322.15
6	$79 322.15	$661.02	$79 983.17	$79 183.17

(i)   How much had Megan and Gary paid off the loan at the end of six months.   1

(ii)   Of the $800 payment made in the second month, how much was interest?   1

(iii)   Complete the table by calculating the amounts marked B , C and D   3

e)   Use the formula:

$$T = 2\pi\sqrt{\frac{l}{g}}$$

3

to find l when $T = 8.3$ and $g = 9.8$. Give your answer correct to three significant figures.
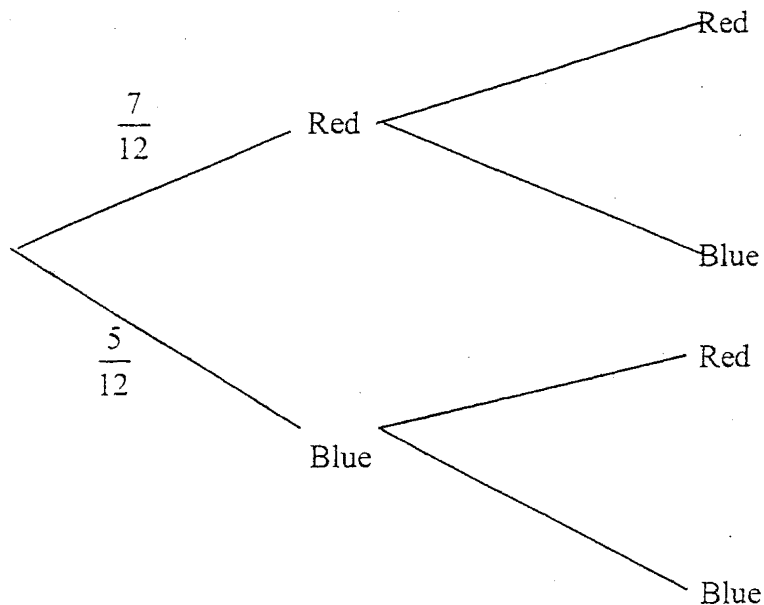
QUESTION 24 (15 marks)   *START A NEW PAGE*   *MARKS*

a)   There are 8 scores in a data set. One of the scores is an outlier. Which of the mean, mode, median or interquartile range will be most influenced by the outlier?   1

b)   A bag contains 7 red and 5 blue marbles. Two marbles are drawn at random, without replacement. A tree diagram has been begun below.

(i)   Copy and complete the tree diagram.   2

(ii)   What is the probability that both marbles are Blue ?   1

(iii)   What is the probability that the marbles are the same colour ?   2

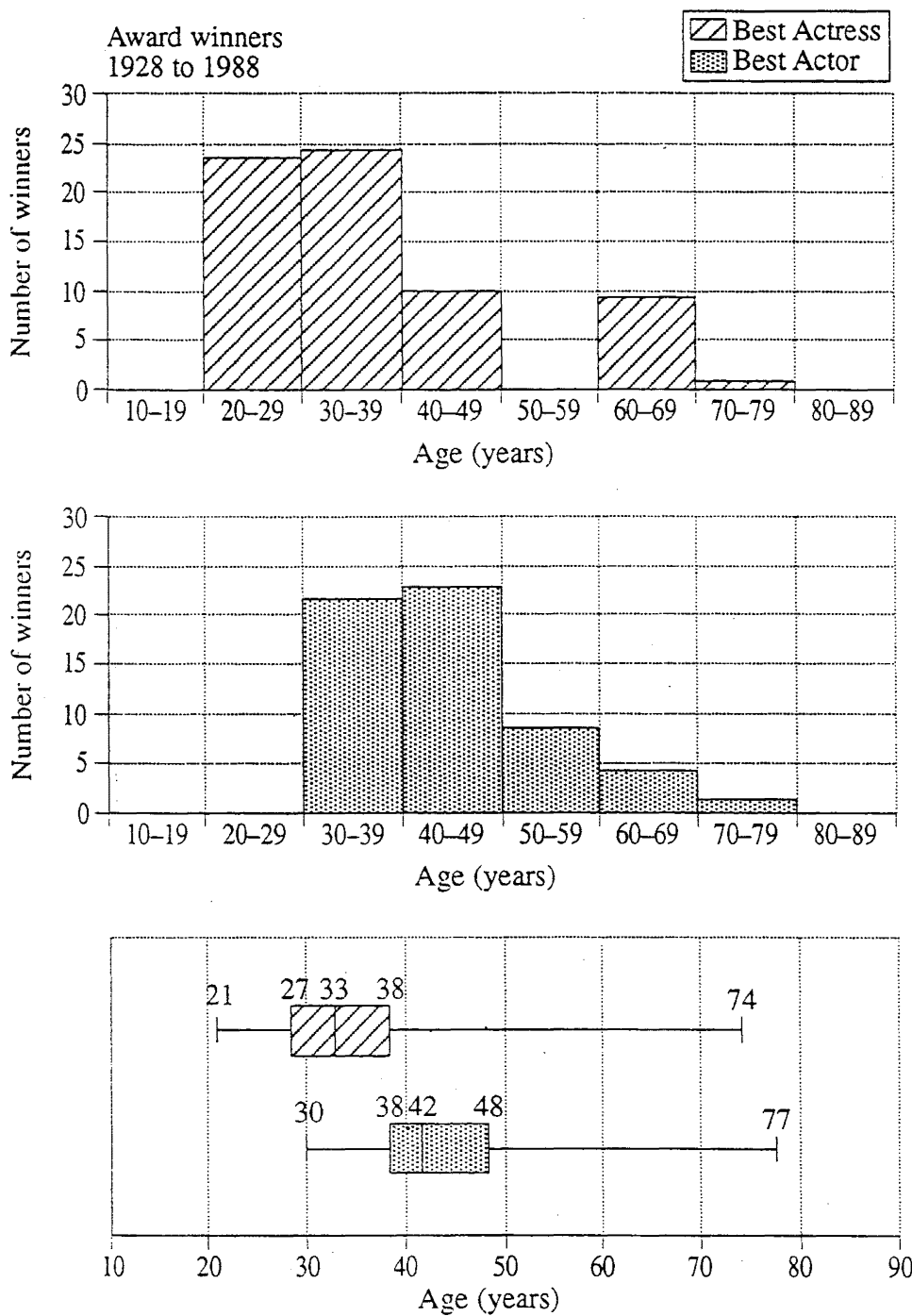(iv)   What is the probability that at least one marble is blue?   2

c) The histograms and box-and-whisker plots below are based on the ages of the winners of the Best Actor and Best Actress awards for the years 1928 to 1988. Study the histograms and box-and-whisker plots carefully and then answer the questions that follow.
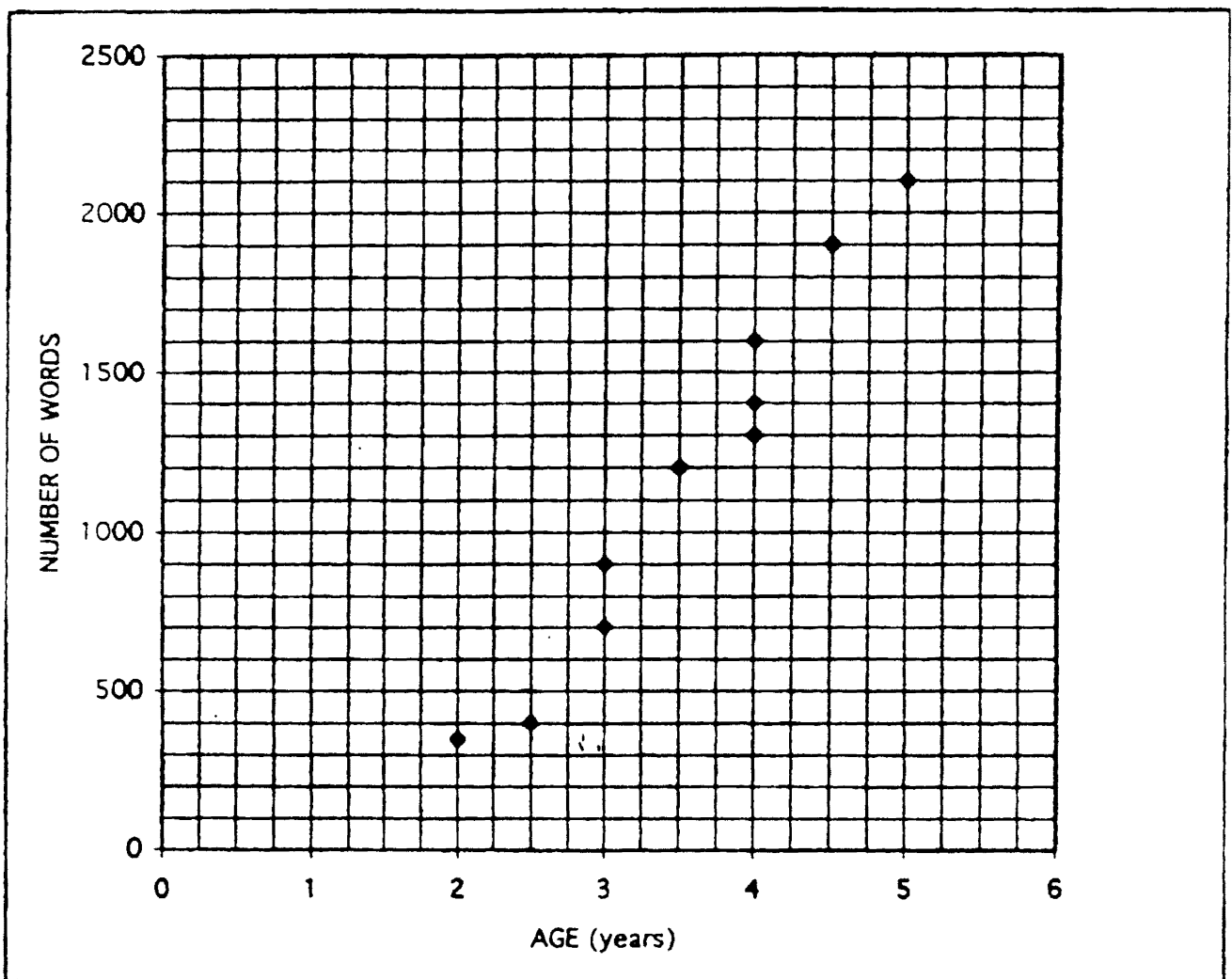

i) Determine the interquartile range for the ages of the winners of the Best Actress award. **1**

ii) Compare and contrast the displays for the Best Actress and Best Actor awards by examining: **4**

- the shape and skewness of the distributions; and

- measures of location and spread.

iii) Use your answer to part (ii) *either* to support *or* to reject the statement: **2**

'Essentially the two setes of data have a similar shape, spread and location and this shows that, as a group, there is little difference between the ages of the actresses and the actors receiving these awards.'

END OF EXAMINATION

QUESTION 22(c)

This page is to be attached to your answers for question 22

$(2mn^2)^4 = 16m^4n^8$ — D
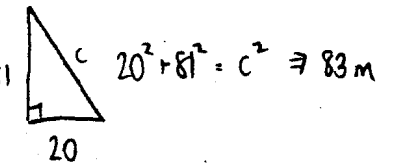
0.008636 — D

$20^2 + 81^2 = c^2 \Rightarrow 83m$ — C

Median — B

$\dfrac{10}{2000} \times \dfrac{9}{1999} \times \dfrac{8}{1998}$ — A

$960 = P \times 0.06 \times 8$
$\therefore P = \$2000$ — B

$\bar{x} \Rightarrow \uparrow$
$\sigma_n \Rightarrow \downarrow$
15 $75\% \times 20$ — **D**

$6 \times 2 \times 2 \times 2 = 48$ — D

$(107.46 \times 12 \times 20) = \$25790.40$

$\therefore \text{Int} = \$10790.40$ — C

$\dfrac{3}{8}$ — C

$\dfrac{16}{365} = 0.04384\%$ — B

$y = \dfrac{x}{4} + 3$ — A

$\sigma_n = 14.37$ — A

...ty, smaller s.d
...re consistent

15/ $\dfrac{1}{2} \times 5 = 2.5g$

$\dfrac{2.5}{375} \times 100 = 0.66...$
$= 0.7\%$ — A

16/ $\dfrac{3}{20} \times 100 = 15\%$
$\therefore 15\% = 70$
$1\% = 4.66...$
$\Rightarrow 100\% = 467$ — C

17/ 6 parts $= 180°$
1 part $= 30°$
3 p $= 90°$
$\therefore 90 - 30 = 60°$ — C

18/ $v^2 = u^2 + 2as$
$u^2 = v^2 - 2as$
$u = \sqrt{v^2 - 2as}$ — C

19/ $170 - 100 = \$70$ — A

20/ $C = 14n + 5$ — D

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a) $\sqrt{2x-1} = 3$
$2x - 1 = 9$
$2x = 10$
$x = 5$ — 2 mks

b) i) $\dfrac{15}{100} \times 1450 = \$217.50$ — 1 mk

ii) Int $= 1232.50 \times 0.095 \times 2$
$= \$234.175$
$\Rightarrow \$234.18$

$P = \$1450 - 217.50$
$= \$1232.50$

$\therefore \text{Total} = 1450 + 238.14$
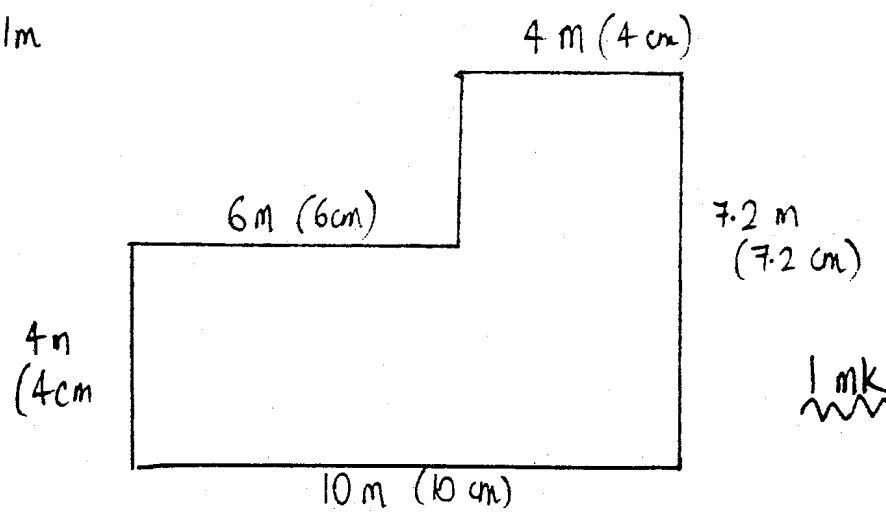$= \$1684.18$ — 2 mks

iii) $=$ Amt left to pay $= \$1466.675$
$\therefore$ fort. repay $= \dfrac{1466.675}{26 \times 2}$
$= \$28.205...$
$= \$28.21$ — 2 mks

c) 1 cm = 1 m

4 m (4 cm)
6 m (6 cm)
7.2 m (7.2 cm)
4 m (4 cm)
10 m (10 cm)

— 1 mk

ii) Area tiles $= 0.4 \times 0.4$ —
$$= 0.16 \text{ m}^2$$
Area room $= 4 \times 6 + 4 \times 7.2$
$$= 52.8 \text{ m}^2$$
$\therefore$ n° tiles $= \dfrac{52.8}{0.16}$
$$= 330 \text{ tiles}$$ 2 mks

d) i.) 120   1 mk
  1 mk

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

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

iv) $\dfrac{93}{120} = \dfrac{31}{40}$

e) $\dfrac{6 \times 5}{2 \times 1} = 15$ combinations   1 mk

Question 22

a) i.) $\dfrac{5.2}{0.65} = 8$ 1 mk

ii) $8 \times 1 = 8 \text{ m}$ 1 mk
   or $\dfrac{x}{1} = \dfrac{5.2}{0.65}$

b) i.) ~ \$170 000 (mthly repay)   1 mk
  ii) ~ 17 yrs   1 mk
  iii) · pay loan off quicker
     · save by paying less interest
       over term of loan   2 mks

c)
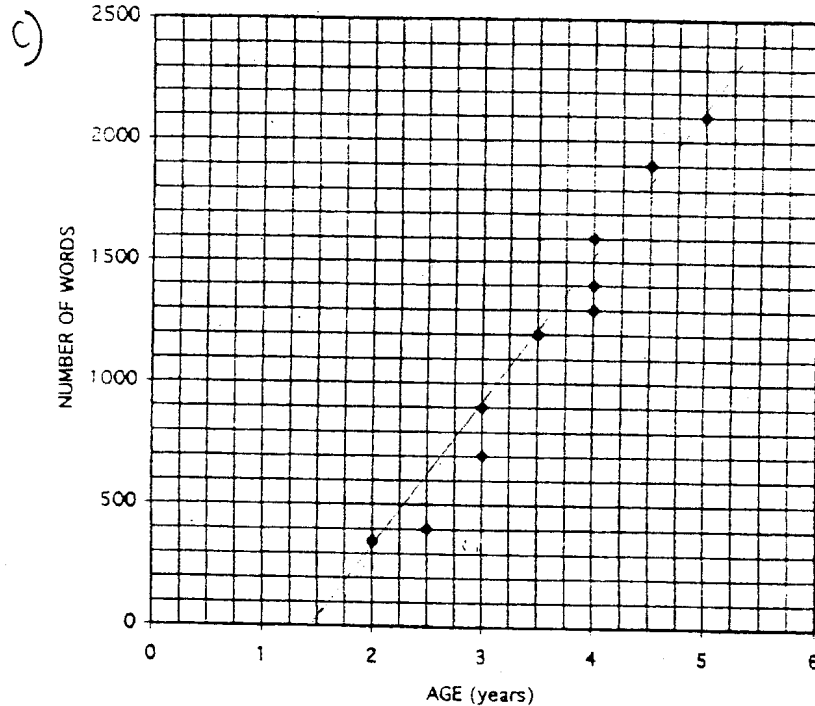
1 mk

ii) ~ 1200 words   1 mk

iii) ~ $1\frac{1}{2}$ yrs   1 mk

iv) av. rate ⇒ (gradient) ~ 600 words/yr   1 mk
   (accept b/t 500 ≟ 700)

v) Justify   2 mk
   - as age increases, so does n° of
     words ~ 600 per year
     (or other justification)

a)

$$D = \frac{kA}{70}$$

$$D = \frac{22.5 \times 12}{70}$$

$= 3.857.. \text{ ml morning} + 3.857.. \text{ ml at night}$

$\therefore$ total per day $= 7.714...$

$\qquad = 7.7$ ml

bottle $= \dfrac{375}{7.714...}$ $\qquad \left(\dfrac{375}{7.7} = 48.7 \text{ days}\right)$

$\qquad = 48.6$ days ✓

$\therefore$ n° days $= \underline{48 \text{ days}}$ $\qquad\qquad$ 3 mks

Question 23

a) i)

$4 \times 3 \times 2 \times 1 = 24$ $\qquad\qquad$ 1mk

ii) $\dfrac{1}{24} / \dfrac{1}{6}$ $(3 \times 2 \times 1)$ $\qquad$ 1mk $\quad$ 1mk $\quad$ NB should be 1mk not 2mk

b) $1.08^N = 3$

i) $1.08^{9.1} = 2.01444...$

$\qquad = 2.01 \ (2 \ dp)$ $\qquad\qquad$ 1mk

ii)

Guess	Check
N = 14	2.93
N = 14.5	3.05
N = 14.3	3.005...

$\therefore N = 14.3 \ (1 \ dp)$

* need a few guesses for full marks
→ must use method asked. $\qquad$ 2 mk

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c) Balance $= \$490$

Int $= 490 \times \dfrac{0.0437}{100} \times 8$

$\qquad = \$1.71304$

$\qquad \approx \$1.71$ $\qquad\qquad$ 2 mk

d) i) $\$79\,183.17$ owed at end of 6mths

$\therefore$ amt paid off $= 80\,000 - \dfrac{79\,183.17}{\$816.83}$ $\qquad$ 1 mk

ii) $\$665.56$ $\qquad\qquad\qquad$ 1 mk

iii) $B = \dfrac{0.10 \times 79\,732.23 \times 1}{12}$ $\qquad \left(\substack{\text{mthly interest} \\ \text{rate} = 0.83..\%}\right)$

$\qquad = \$664.43525$

$\qquad = \$664.44$ $\qquad\qquad$ 1 mk

$C = 79\,732.23 + 664.44$ $\qquad\qquad$ 3 mk

$\qquad = \$80396.66525$

$\qquad = \$80396.67$ $\qquad\qquad$ 1 mk

$D = 80396.67 - 800$ $\qquad (\text{or look at mth 4})$

$\qquad = \$79596.67$ $\qquad\qquad$ 1 mk

e) $T = 2\pi\sqrt{\dfrac{l}{g}}$

$8.3 = 2\pi\sqrt{\dfrac{l}{9.8}}$

$\dfrac{8.3}{2\pi} = \sqrt{\dfrac{l}{9.8}}$

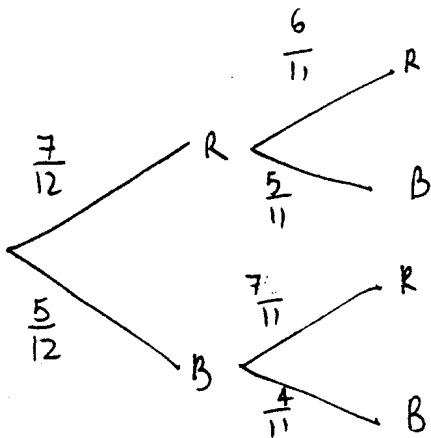$\therefore l = \left(\dfrac{8.3}{2\pi}\right)^2 \times 9.8$

$\qquad = 17.1010...$

$\begin{cases} l = 17.1 \\ (3 \text{ sig. figures}) \\ (-1 \text{ for not having 3 sig. figures}) \end{cases}$ $\qquad$ 3 mks

Question 24

a) outlier will influence mean   1 mk

b) i)

$\frac{7}{12}$ → R, $\frac{6}{11}$ → R, $\frac{5}{11}$ → B
$\frac{5}{12}$ → B, $\frac{7}{11}$ → R, $\frac{4}{11}$ → B

2 mk

* need all n's correct for 2 mks (-1 for each mistake)

ii) $P(BB) = \frac{5}{12} \times \frac{4}{11}$

$= \frac{5}{33}$ 1 mk

iii) $P(BB)$ or $P(RR)$

$= \left(\frac{5}{12} \times \frac{4}{11}\right) + \left(\frac{7}{12} \times \frac{6}{11}\right)$ 2 mks

$= \frac{5}{33} + \frac{7}{22}$

$= \frac{31}{66}$

iv) $P(\text{at least one}) = 1 - P(\text{none})$

$= 1 - P(RR)$

$= 1 - \left(\frac{7}{12} \times \frac{6}{11}\right)$

$= 1 - \frac{7}{21} \rightarrow \frac{15}{22}$ 2 mks

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c) i) Iar bes? ne... = 11   1 mk

ii)

	Best Actor	Best Actress
· shape/skew	positively skewed	positively skewed
· location — median	42	33
mode	40-49 yrs	30-39 yrs
· spread — IQR	48-38 = 10	38-27 = 11
— range	77-30 = 47	74-21 = 53

4 mks

· similar overall shape (⇒ positive skew)
· similar spread (⇒ range & IQR)
· difference — measures of location
            — median age for Best Actor is signif-
            icantly higher than for Best Actress

· for 4 mks — need to look at each of the categories
      → cannot use words "spread" — must use IQR/
        range etc
3 mks for a table + 1 mk explaining similarities/
differences.

* NB Must use numbers to support statements
   (no numbers, no marks! → need to justify
    your reasoning!)