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BROADRICK SECONDARY SCHOOL

SECONDARY 4 EXPRESS

PRELIMINARY EXAMINATION 2023

MATHEMATICS

4052/01

Paper 1

Aug 2023

Candidates answer on the Question Paper

2 hours 15 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

The number of marks is given in brackets [] at the end of each question or part question.

The total of the marks for this paper is 90.

For Examiner's Use		
Error In	Question Number	Marks Deducted
Rounding-off		
Reasoning		
Presentation		

For Examiner's Use
90

This document consists of 19 printed pages.

[Turn Over

Mathematical Formulae*Compound interest*

$$\text{Total amount} = P \left(1 + \frac{r}{100} \right)^n$$

Mensuration

$$\text{Curved Surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

$$\text{Volume of a cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Area of triangle } ABC = \frac{1}{2} ab \sin C$$

$$\text{Arc length} = r\theta, \text{ where } \theta \text{ is in radians}$$

$$\text{Sector area} = \frac{1}{2} r^2 \theta, \text{ where } \theta \text{ is in radians}$$

Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

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

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f} \right)^2}$$

Answer **all** the questions.

- 1 (a) Calculate $\sqrt{1009 - (-0.2)^2}$.

Write down the first five digits on your calculator display.

Answer [1]

- (b) Write your answer to part (a) correct to 2 significant figures.

Answer [1]

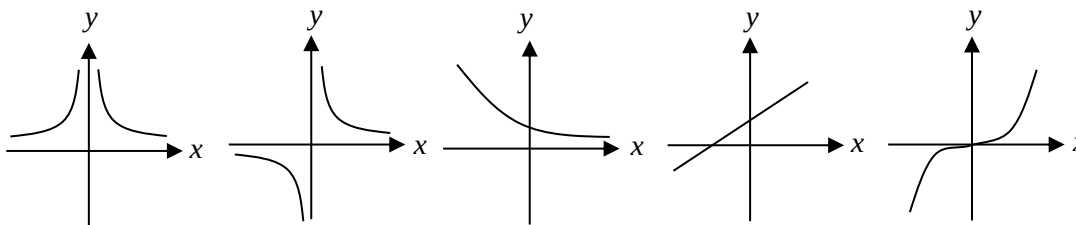
- 2 (a) Simplify fully $(3\sqrt{p^3})^4$.

Answer [1]

- (b) Given that $\frac{x^5}{x^{-2}} = x^n$, find n .

Answer $n =$ [1]

3



Graph A

Graph B

Graph C

Graph D

Graph E

Identify and write down a possible graph for each of the equations below.

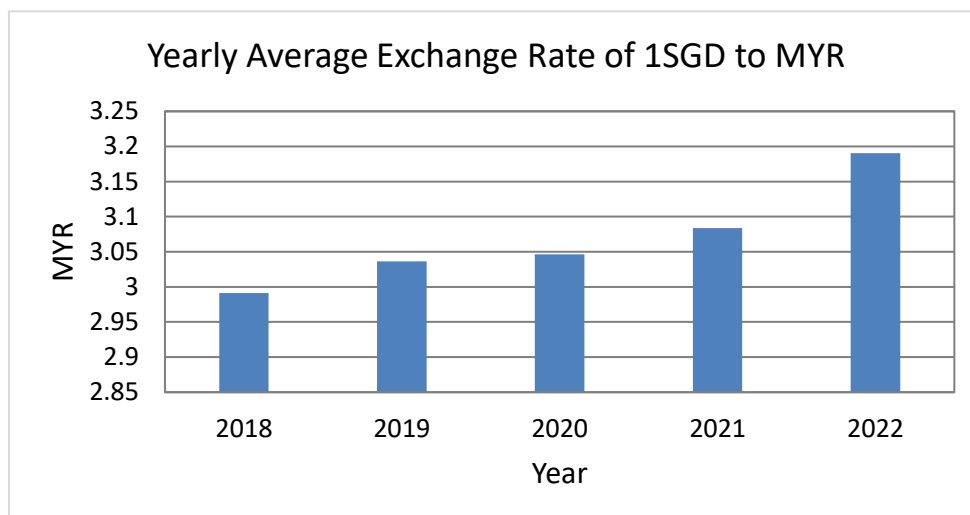
- (a) $y = 3x^{-2}$,

Answer Graph [1]

- (b) $y = 2x + 3$.

Answer Graph [1]

- 4 The bar chart below shows the yearly average exchange rate of one Singapore dollar (SGD) to Malaysia Ringgit (MYR) from 2018 to 2022.



State one aspect of the chart that may be misleading and explain how this may lead to a misinterpretation of the chart.

Answer

.....

.....

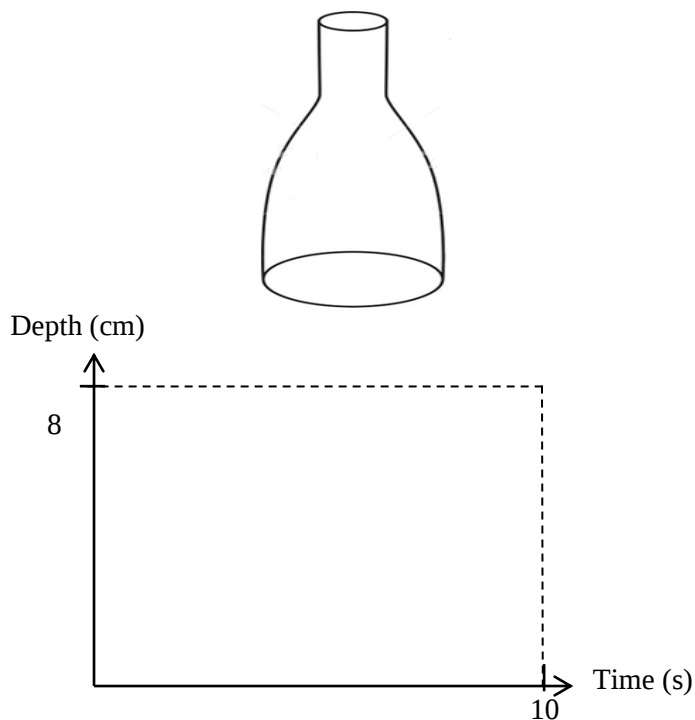
..... [2]

- 5 The equations of two straight lines are $ax + y - 8 = 0$ and $\frac{x}{3} + \frac{y}{2} = 5$.

Given that the lines are parallel, find the value of a .

Answer $a =$ [2]

- 6 The diagram shows a vase of height 8 cm.
 Water is poured into the vase at a constant rate.
 It takes 10 seconds to fill the vase.
 On the axes in the answer space, sketch the graph showing how the depth varies during the 10 seconds.



[2]

- 7 It is given that $108 = 2^2 \times 3^3$,
 $120 = 2^3 \times 3 \times 5$ and
 $1800 = 2^3 \times 3^2 \times 5^2$.

(a) Find the largest integer that will divide 108, 120 and 1800 exactly.

Answer [1]

- (b) m is a number between 500 and 1000.
 The lowest common multiple of 120 and m is 1800.
 Find the value of m .

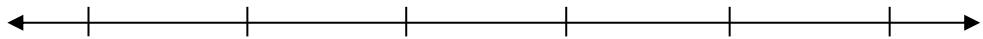
Answer $m =$ [1]

- 8 (a)** Solve the inequalities $-3 \leq x+1 < \frac{5-x}{2}$.

Answer [2]

- (b)** Hence represent the solution on the number line given below.

Answer



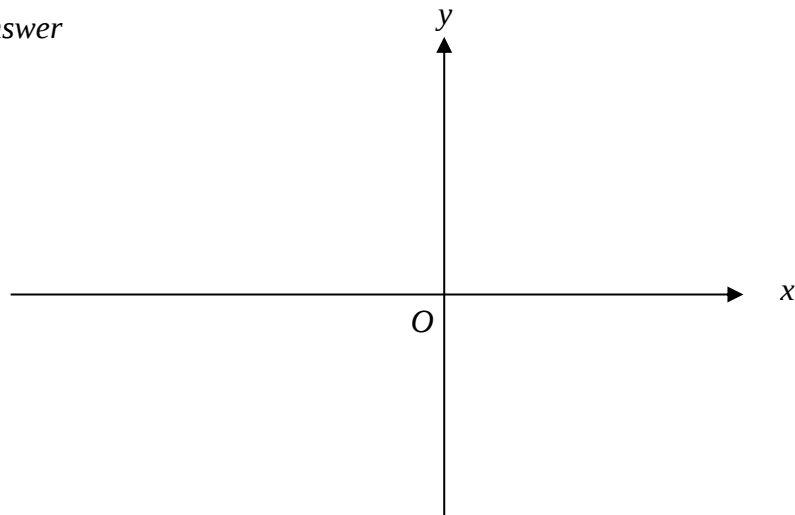
[1]

- 9** Given that $p = \frac{2(1+q)}{3q-1}$, express q in terms of p .

Answer $q =$ [3]

- 10 (a)** Sketch the graph of $y = -(x+1)^2 + 2$, showing clearly the coordinates of the turning point and y-intercept.

Answer



[2]

- (b)** Write down the equation of the line of symmetry of $y = -(x+1)^2 + 2$.

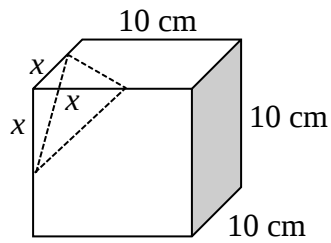
Answer [1]

- 11** Solve the equation $\frac{2}{x+3} + \frac{8}{9-x^2} = 2$.

Answer $x = \dots\dots\dots$ or $\dots\dots\dots$ [4]

- 12** The diagram shows a cube of sides 10 cm each.

A right-angled triangular pyramid of sides x cm is cut from a corner of the cube.
Given that the volume of the remaining cube is 987.652 cm^3 , find the value of x .



Answer $x = \dots\dots\dots$ [3]

- 13** Factorise completely.

(a) $5y^4 - 20x^2$

Answer $\dots\dots\dots$ [1]

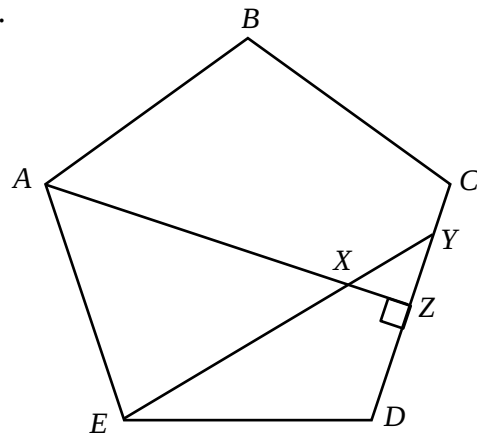
(b) $3ax - 6ay - bx + 2by$

Answer $\dots\dots\dots$ [2]

- 14** Box *A* is 50% larger than Box *B* while Box *C* is 10% smaller than Box *B*.
Find the ratio of the size of Box *A* to that of Box *C*.

Answer : [2]

- 15** The diagram shows a regular pentagon *ABCDE*.
Y and *Z* are points on *CD*.
AZ is perpendicular to *CD*.
EY intersects *AZ* at *X*.



Given that angle *AXE* is 50° , find angle *CEY*.

Answer $^\circ$ [5]

- 16** Three of the vertices of a parallelogram $ABCD$ are $A(4,6)$, $B(8,4)$ and $C(6,0)$ respectively.

(a) Find the coordinates of D .

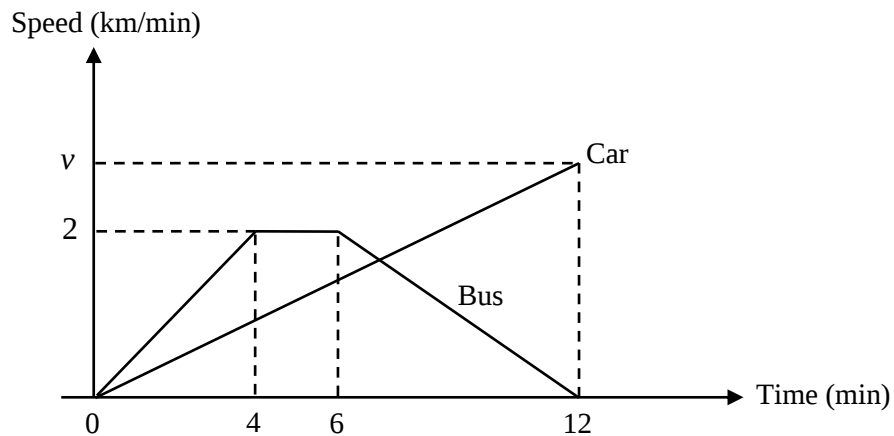
Answer $D = (\dots\dots\dots, \dots\dots\dots)$ [2]

- (b)** Justify if $ABCD$ is a rhombus.
Show your workings clearly.

Answer

[2]

- 17 The diagram shows the speed-time graphs of a car and a bus during a period of 12 minutes. The car and the bus start from the same point at the same time and travel in the same direction.



- (a) Calculate the retardation of the bus at 9 minutes.

Answer km/min^2 [2]

- (b) Given that the two vehicles travelled the same distance in 12 minutes, calculate the speed of the car, v km/min, at the end of the 12 minutes.

Answer $v =$ km/min [2]

- 18** The period of a pendulum, T , is directly proportional to the square root of L , the length of the pendulum.

Find the percentage increase in T when L is increased by 800%.

Answer % [3]

- 19** The universal set, $\mathcal{E} = \{x : x \text{ is a factor of } 36\}$.

$$A = \{x : x \text{ is a multiple of } 3\}.$$

$$B = \{x : x \text{ is divisible by } 6\}.$$

- (a)** List the elements of the sets $\mathcal{E}$, A and B .

Answer $\mathcal{E} = \dots\dots\dots$

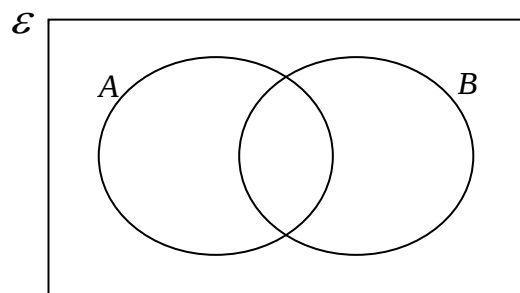
$A = \dots\dots\dots$

$B = \dots\dots\dots$ [2]

- (b)** Find $(A \cap B)'$.

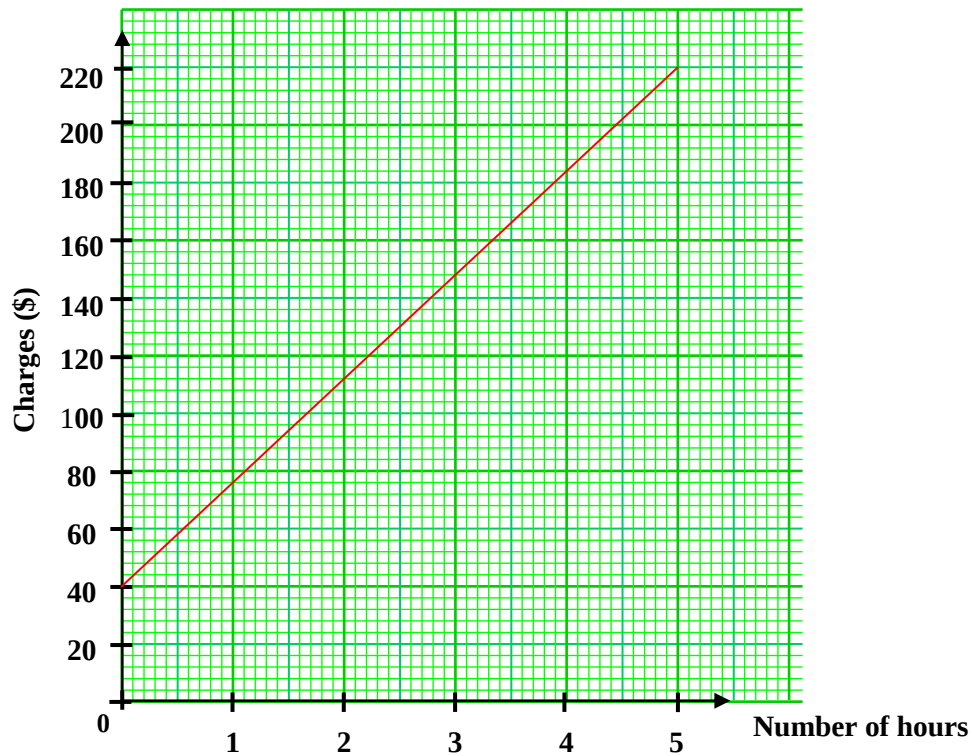
Answer [1]

- (c)** Shade the Venn diagram that represents $(A' \cup B) \cap A$.



[1]

- 20 The graph shows the charges to carry out household plumbing repairs by Samuel. The total charges are made up of a basic cost, $\$C$, together with a rate of $\$x$ per hour.



- (a) Use the graph to find the charges for 3 hours of plumbing repairs in a home.

Answer \$ [1]

- (b) Find the values of C and of x .

Answer $C =$ [1]

$x =$ [1]

- (c) Lionel, another plumber, charges $\$50$ for each hour of plumbing repairs. He claims that his charges are cheaper as he does not charge a basic cost. Justify if Lionel's claim is valid.

Answer

[2]

- 21 (a)** Mr Gan made a loss of 15% when he sold his apartment in Perth, Australia for AUD\$289 000.
Find the original value of his apartment.

Answer AUD\$ [1]

- (b)** Mr Gan then invested AUD\$289 000 for 3 years in a bank which pays him a compound interest of 4% per annum compounded half yearly.
Calculate the interest he earned at the end of 3 years, correct to the nearest AUD\$.

Answer AUD\$ [2]

- (c)** On a certain day, the exchange rate between the Australian dollar (AUD), the United States dollar (USD) and the Singapore dollar (SGD) are given below.

$$\text{SGD\$1} = \text{AUD\$1.13}$$

$$\text{USD\$1} = \text{AUD\$1.52}$$

Mr Gan imported a printing machine from the United States that costs USD\$4500.
Find the price of the printing machine in Singapore dollars, correct to the nearest cents.

Answer S\$ [2]

- 22 The number triangle in the table below is made up of consecutive odd numbers.

Row	Number Triangle	Sum of Row	Last Element of Row
1	1	1	1
2	3 5	8	5
3	7 9 11	27	11
4	13 15 17 19	64	19
5	21 23 25 27 29	125	29
:		:	:
n		p	q

- (a) Write down the 6th row of the pattern in the table below.

Row	Number Triangle	Sum of Row	Last Element of Row
6			

[1]

- (b) Express p in terms of n .

Answer $p = \dots\dots\dots$ [1]

- (c) Given that $q = n^2 + n - 1$, determine if it is possible for the last element of a row to be 159.

Answer

.....

.....

..... [1]

- 23 A furniture owner makes tables and chairs.

The following table shows the amount of labour in hours, blocks of wood and tins of paint needed to make a table and a chair.

	Number of hours of labour	Number of blocks of wood	Number of tins of paint
Table	5	15	2
Chair	3	6	1

This information can be represented by the matrix $\mathbf{M} = \begin{pmatrix} 5 & 15 & 2 \\ 3 & 6 & 1 \end{pmatrix}$.

- (a) Labour cost \$9 per hour, wood cost \$10 per block and paint cost \$22 per tin. Represent this information by a 3×1 column matrix $\mathbf{C}$.

Answer $\mathbf{C} = \dots\dots\dots$ [1]

- (b) Evaluate the matrix $\mathbf{V} = \mathbf{MC}$.

Answer $\mathbf{V} = \dots\dots\dots$ [2]

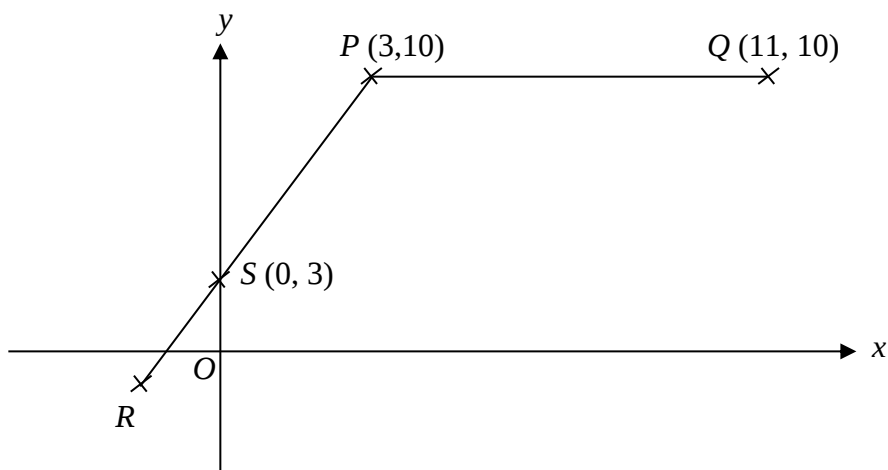
- (c) State what the elements of $\mathbf{V}$ represent.

Answer $\dots\dots\dots$
 $\dots\dots\dots$
 $\dots\dots\dots$ [1]

- (d) The matrix $\mathbf{S}$, where $\mathbf{S} = \mathbf{WV}$, represents the total cost of making 3 tables and 12 chairs. Write down the matrix $\mathbf{W}$.

Answer $\mathbf{W} = \dots\dots\dots$ [1]

- 24 The diagram shows a sketch of two straight lines PQ and PSR .
The coordinates of P , Q and S are $(3, 10)$, $(11, 10)$ and $(0, 3)$ respectively.
It is also given that $PS = 2SR$.



- (a) Find the equation of the line PSR .

Answer [2]

- (b) Find the coordinates of R .

Answer $R = (\text{.....}, \text{.....})$ [1]

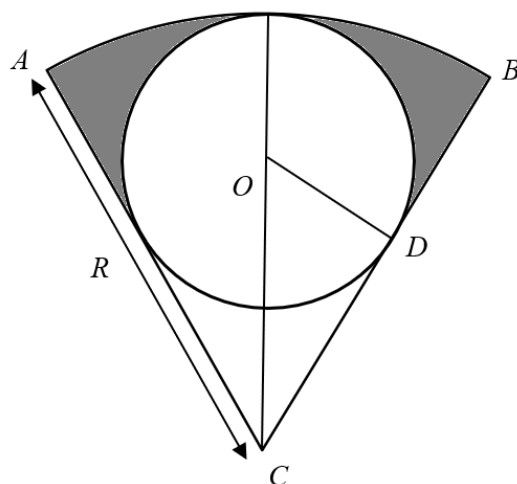
- (c) Calculate the area of triangle PQS .

Answer units² [2]

- 25 The diagram shows a circle with centre O and radius r cm, inscribed in a sector with centre C and radius R cm.

D is the point where BC touches the circle.

Angle $ACB = \frac{\pi}{3}$ radians.



- (a) Show that $R = 3r$.

Answer

[2]

- (b) Hence, find the area of the shaded region in terms of r .

Answer cm² [4]

- 26 The masses (in kg) of 7 male and 8 female members in a rowing club are shown in the stem-and-leaf diagram below.

Leaf (Males)	Stem	Leaf (Females)
	5	8 9
8 5	6	2 3 5 5 8
5 5 3	7	0
8 4	8	
Key: 5 6 means 65		Key: 5 8 means 58

- (a) Find the mean mass of the female members.

Answer kg [1]

- (b) Find the modal mass of all the members in the rowing club.

Answer kg [1]

- (c) One male and one female club member are chosen for a competition.
Find the probability that the male member has a mass of more than 80 kg and the female member has a mass less than 60 kg.

Answer [2]

- (d) The median mass of the male members remains at 75 kg after a new male member joins the club.
Given that the new male member weighs x kg and that he is not the heaviest member in the club, state the range of values of x .

Answer [2]

End of Paper