

EXP

TAMPINES SECONDARY SCHOOL

SECONDARY FOUR EXPRESS

PRELIMINARY EXAMINATIONS 2026

NAME

CLASS

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REGISTER NUMBER

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MATHEMATICS (EXPRESS)
PAPER 2**4052**
25 August 2026
2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and register 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** the 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.

The number of marks is given in brackets [] at the end of each question or part question.
The total number of marks for this paper is **90**.

For Examiner's Use**90**

Mathematical Formulae*Compound Interest*

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

Mensuration

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

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

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

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

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

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

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

Trigonometry

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

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

Statistics

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

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

Answer **all** the questions.

- 1 (a) (i) Given the formula $p = \frac{4q - 5r}{q + r}$, find p when $q = 5$ and $r = -2$.

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

- (ii) Rearrange the formula $p = \frac{4q - 5r}{q + r}$ to make q the subject.

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

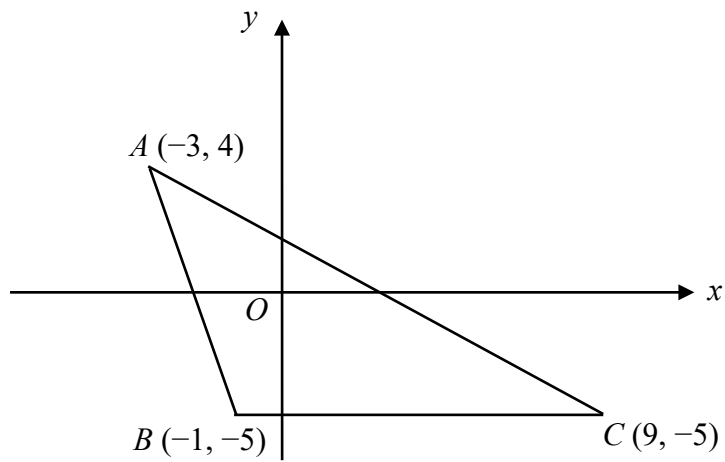
- (b) Factorise $x^2 - 3x + 9y - 3xy$.

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

(c) Solve $2x^2 - 5x - 7 = 0$.

Answer: $x = \dots\dots\dots$ or $\dots\dots\dots$ [2]

2 Triangle ABC has coordinates $A (-3, 4)$, $B (-1, -5)$ and $C (9, -5)$.



(a) Find the equation of AC ,

Answer $\dots\dots\dots$ [3]

- (b) Calculate the length of AC .

Answer unit [1]

- (c) Calculate the area of triangle ABC .

Answer unit² [1]

- (d) State the coordinates of D such that $ACDB$ form a parallelogram.

Answer (.....,) [1]

- (e) The equation of a line p is $4y + 3x = 4$.
Determine if the line p will intersect line AC . Explain your answer with mathematical working.

Answer

.....
.....
.....

[2]

- 3 Tickets to a carnival cost \$10 for adults (A), \$8 for senior citizens (S) and \$5 for

children (C). This information can be represented by the matrix $\mathbf{Q} = \begin{pmatrix} 10 \\ 8 \\ 5 \end{pmatrix}$.

- (a) 68 adults, 15 senior citizens and 70 children bought tickets through ticket counter. 72 adults and x children bought tickets online. Represent this information in a 2×3 matrix $\mathbf{P}$.

Answer

$$\mathbf{P} = \begin{matrix} & \begin{matrix} \text{A} & \text{S} & \text{C} \end{matrix} \\ \begin{pmatrix} & & \end{pmatrix} \end{matrix} \quad [1]$$

- (b) Find the matrix $\mathbf{R}$, in terms of x such that $\mathbf{R} = \mathbf{PQ}$.

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

- (c) Explain what each element in matrix $\mathbf{R}$ represents.

.....
 [1]

- (d) The total amount of money collected from the ticket counter is less than that from the online sales.

Find the least value of x .

Answer [2]

4 The capacity of a tank is 3853 litres.

- (a) Tap A can fill the tank at a speed of x litres per minute. Write down an expression, in terms of x , for the duration (in minutes) taken by Tap A .

Answer minutes [1]

- (b) Tap B can fill the tank at a speed of $(x - 2)$ litres per minute. Write down an expression, in terms of x , for the duration (in minutes) taken by Tap B .

Answer minutes [1]

- (c) Tap B will take 30 minutes longer than Tap A to fill the tank. Write down an equation in x and show that it reduces to $15x^2 - 30x - 3853 = 0$.

Answer

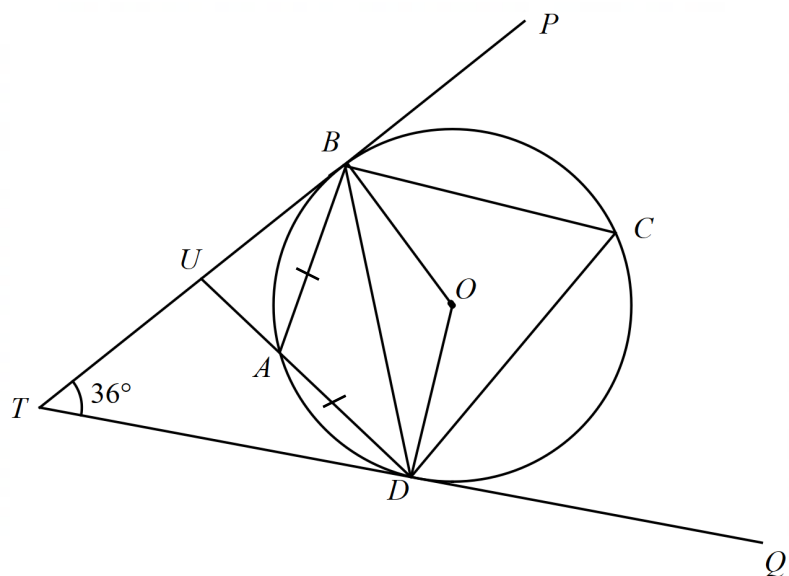
- (d) Solve the equation $15x^2 - 30x - 3853 = 0$, leaving your answers to 2 decimal places.

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

- (e) Hence, find the time taken for the tank to be filled if both taps are turned on, correct your answer to the nearest minute.

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

- 5 In the diagram, O is the centre of the circle $ABCD$. TBP and TDQ are tangents to the circle, angle $BTU = 36^\circ$ and $AB = AD$.



Giving reasons for each step of your working, find

- (a) (i) angle BOD ,

Answer Angle $BOD = \dots\dots\dots$ [2]

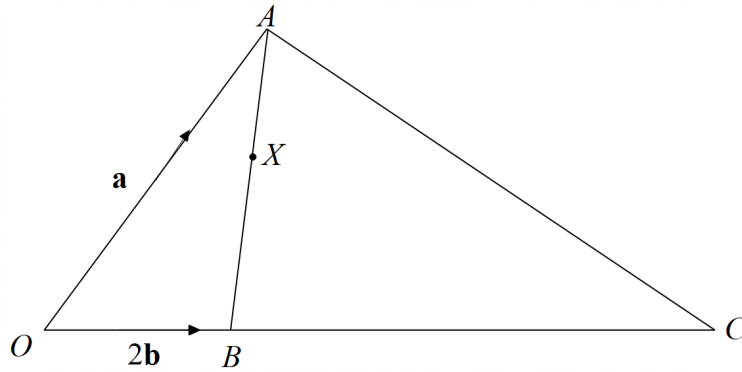
(a) (ii) angle ABD ,

Answer Angle ABD [2]

(b) Show that AB bisects angle UBD .

Answer

- 6 OAC is a triangle and B is a point on OC .
 $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = 2\mathbf{b}$ and $OB : BC = 2 : 3$.
 X is the point on AB such that $AX : XB = 1 : 2$.



- (a) Express $\overrightarrow{AC}$, as simply as possible, in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer [1]

- (b) Express $\overrightarrow{XB}$, as simply as possible, in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer [2]

- (c) Y is the point on BC such that $\overrightarrow{XY}$ is parallel to $\overrightarrow{AC}$.
Find $\overrightarrow{XY}$, in terms of $\mathbf{a}$ and $\mathbf{b}$.

Answer [2]

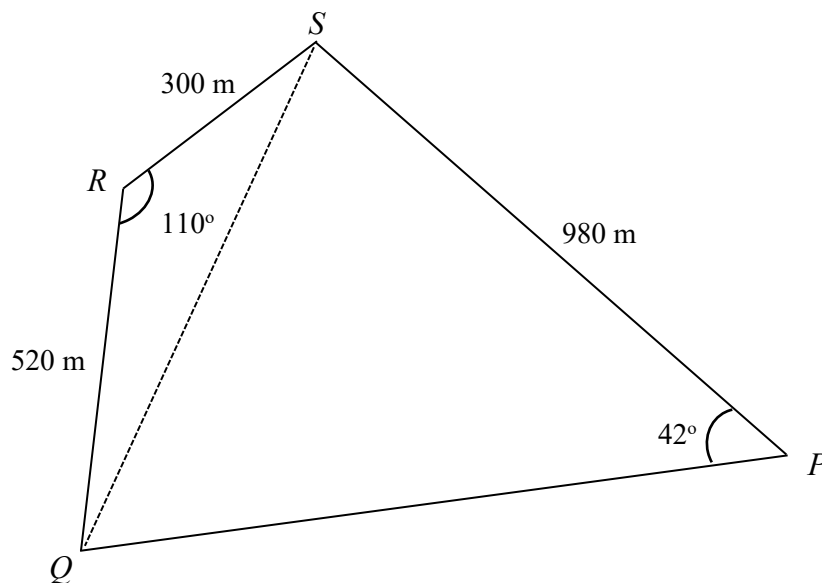
- (d) Find the ratio of the area of triangle AOB : area of triangle ABC .

Answer : [1]

- (e) Find the value of $\frac{\text{area of triangle } BXY}{\text{area of trapezium } AXYC}$.

Answer [1]

- 7 In the diagram, P , Q , R and S are four points on horizontal ground.
 $QR = 520$ m, $RS = 300$ m, $PS = 980$ m, angle $QRS = 110^\circ$ and angle $QPS = 42^\circ$.



- (a) Show that $QS \approx 683.455$ m.
Answer

[2]

- (b) Calculate angle PSQ .

(continue your work in the next page)

Answer $\text{Angle } PSQ = \dots\dots\dots$ [3]

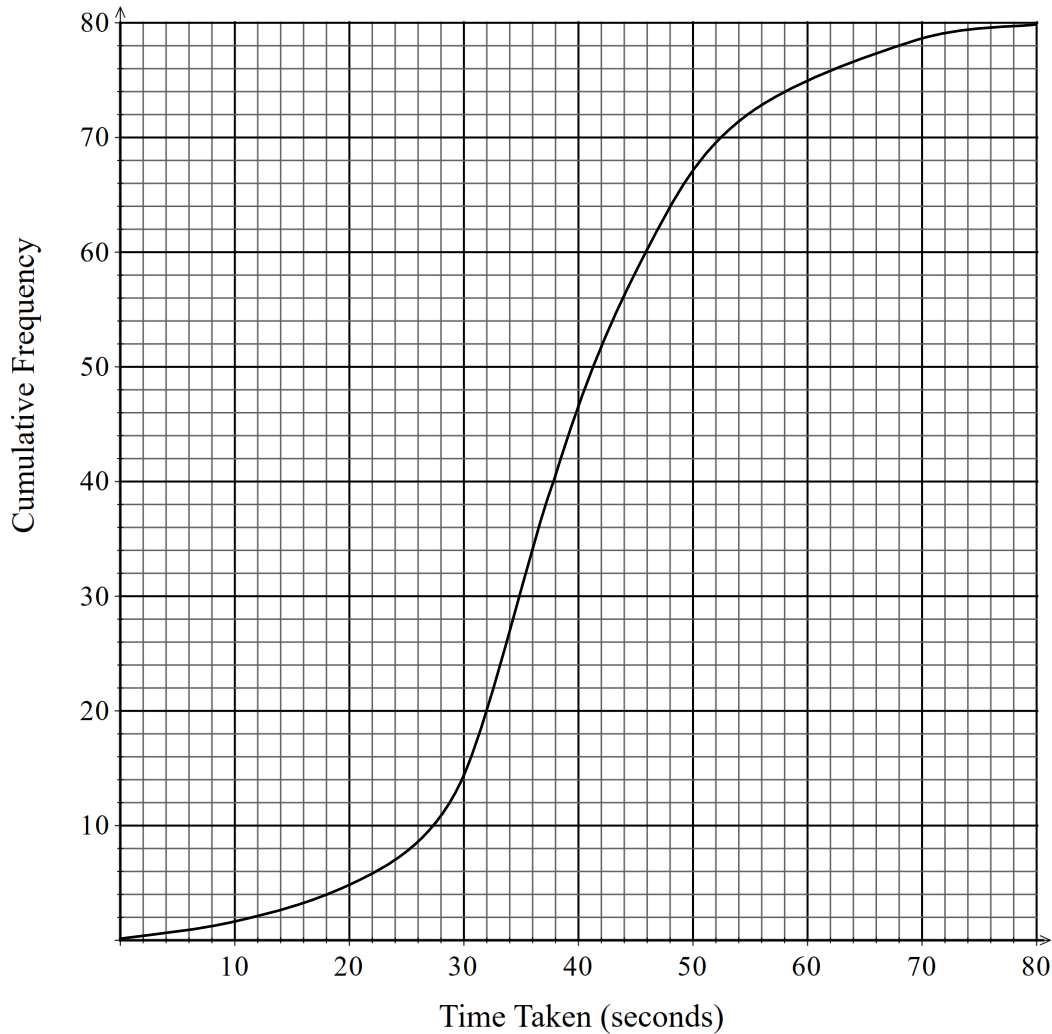
- (c) Find the shortest distance from Q to the line PS .

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

- (d) A drone flies at a height of 1 km above the line SP . Find the greatest angle of elevation when viewed from Q .

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

- 8 A study was conducted on the cognitive skills of adults with age. The study recorded the time 80 adults spent solving a number puzzle. The cumulative frequency curve shows the distribution of the time taken.



- (a) Use the curve to estimate
 (i) the median time taken,

Answerseconds [1]

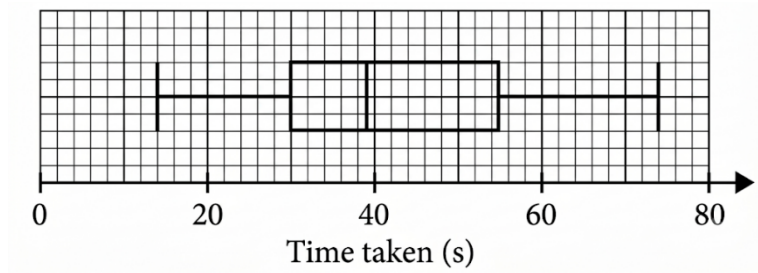
- (ii) the interquartile range of the time taken.

Answerseconds [2]

- (b) 20% of the adults took more than n seconds to solve the puzzle. Find n .

Answer $n = \dots\dots\dots$ [2]

- (c) The same group of adults were each given a word puzzle to solve.
The box-and-whisker plot shows the distribution of the time taken.



Make two comparisons between the performances of the adults in solving the two puzzles.

Answer

.....

.....

.....

.....

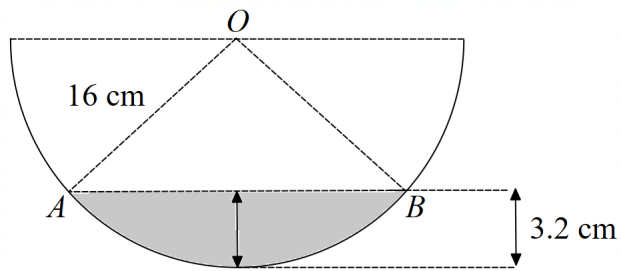
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[2]

- 9 The diagram shows a semicircle, centre O , radius 16 cm.



- (a) Show that angle $AOB = 1.287$ radians, correct to 3 decimal places.

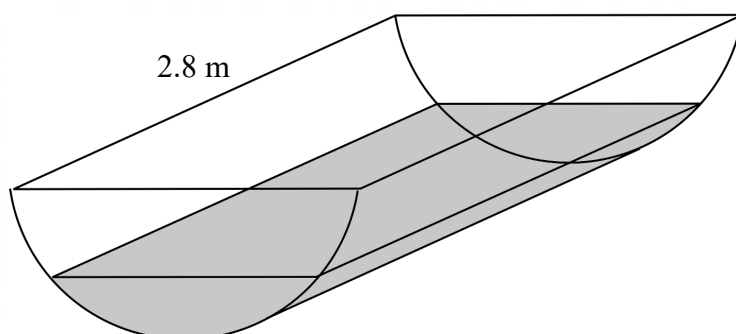
Answer

[2]

- (b) Calculate the area of the shaded region.

Answer cm^2 [3]

- (c) The semicircle is the cross section of a water trough of length 2.8 m, lying on level ground. The shaded area represents the water in the trough.



- (i) Calculate the volume of water, in cm^3 , in the trough.

Answer cm^3 [2]

- (ii) Calculate the number of litres of water that must be added to fill the trough.

Answer l [3]

- 10** The table below shows some values of x and its corresponding values of y for the graph of $y = x^2 + \frac{50}{x} - 20$.

x	0.5	1	1.5	2	3	4	6	8
y	80.3	31	15.6	9	5.7	p	24.3	50.3

- (a)** Calculate the value of p .

Answer [1]

- (b)** On the grid in the next page, draw the graph of $y = x^2 + \frac{50}{x} - 20$ for $0.5 \leq x \leq 8$. [3]

- (c)** Draw a tangent and find the gradient of $y = x^2 + \frac{50}{x} - 20$ at the point where $x = 4$.

Answer gradient = [2]

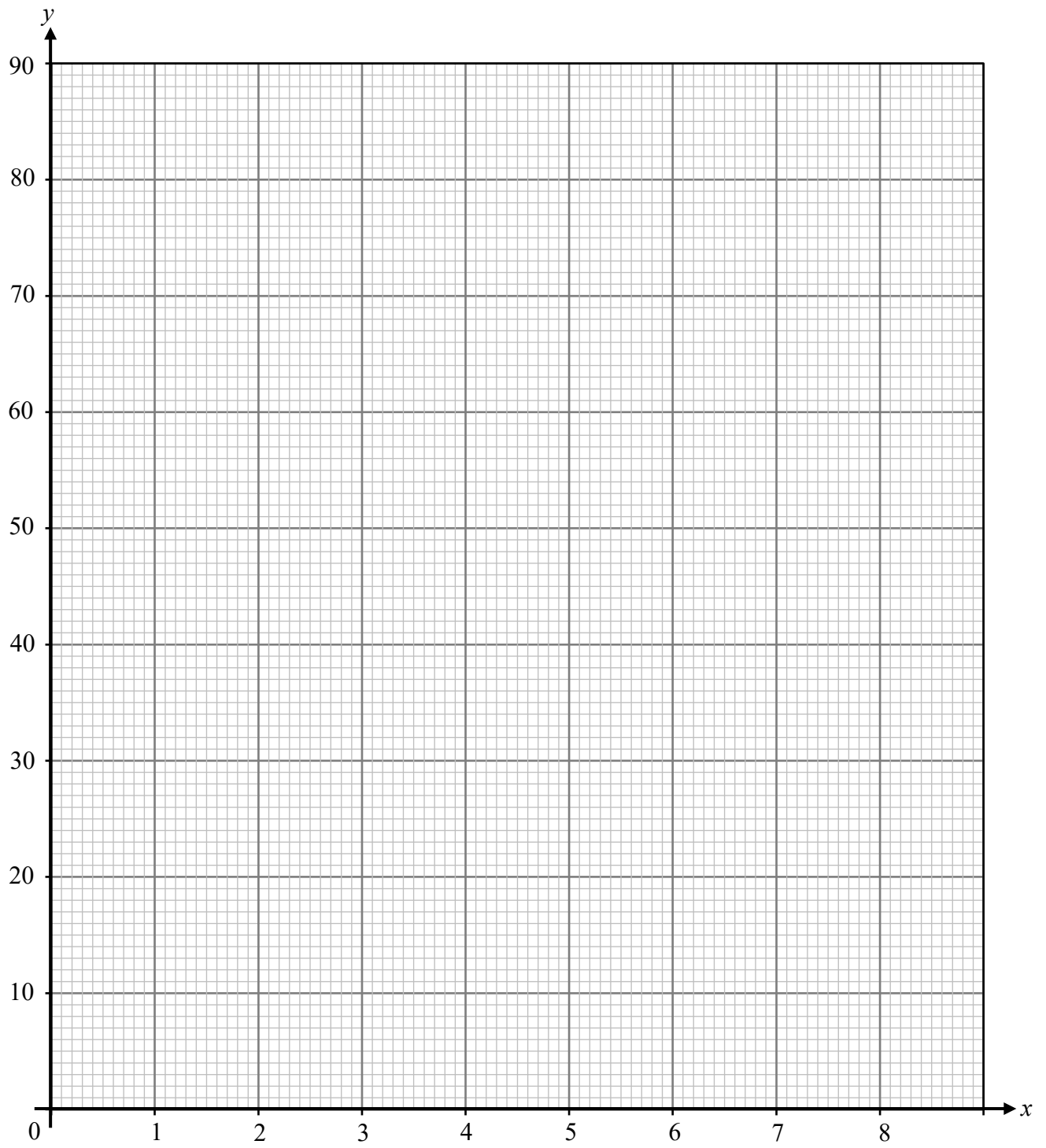
- (d) (i)** Show that equation $x^3 - 2x^2 - 48x + 50 = 0$ can be solved by drawing the line $y = 2x + 28$.

Answer

[2]

- (ii)** By drawing the line $y = 2x + 28$, solve the equation of $x^3 - 2x^2 - 48x + 50 = 0$ for $0.5 \leq x \leq 8$.

Answer $x =$ or [2]



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Please Refer to the Next Page for Question 11

- 11 Medishield Life is a national health insurance scheme for Singaporeans. The household monthly income per person is used to determine the subsidies available to Singaporeans for the payment of Medishield Life. Its formula is as follows:

$$\text{Monthly household income per person} = \frac{\text{Total Gross Household Monthly Income}}{\text{Number of Family Members in the Household}}$$

Table A: Premium Subsidy Rates for Singapore Citizens based on Monthly Household Income Per Person			
Age Next Birthday	Lower Income \$0 - \$1,500	Lower Middle Income \$1,501 - \$2,600	Upper Middle Income \$2,601 - \$3,600
51 - 60	35%	30%	20%
61 - 70	40%	35%	25%
71 - 80	45%	40%	30%
81 - 85	50%	45%	30%
86 - 90	55%	50%	35%
> 90	60%	55%	40%

<https://www.moh.gov.sg/managing-expenses/schemes-and-subsidies/medishield-life/medishield-life-premium-and-subsidy-tables/>

- (a) (i) Mr Tan lives with his two parents who are not working. All three of them are Singaporeans. He earns a monthly gross income of \$8000. Calculate Mr Tan's monthly household income per person.

Answer \$..... [1]

- 11 (a) (ii) Mr Tan's mother is 65 years old in 2026. Her Medishield Life yearly premium is \$1200 before any subsidies shown in Table A. She is also entitled to an additional Merdeka subsidy of 5% of the amount after any subsidy applied. Calculate the yearly premium amount that she has to pay.

Answer \$..... [2]

- 11 (b) Mr Tan's mother will be undergoing hip-replacement surgery in October 2026. Table B shows the estimated bill for the surgery under 4 different wards. Medishield Life covers a certain percentage of a Singaporean's hospital bill, while the rest of the bill is payable via Medisave and /or cash. Table C shows Mr Tan's estimated expenses for the month of October 2026.

TABLE B: ESTIMATED HOSPITAL WARD PLAN CHARGES				
Item Description	Amount (SGD)			
	A (Single Bed)	B1 (4 Beds)	B2 (6 Beds)	C (8 Beds)
Ward Charges, Operation Fees & other Miscellaneous Charges	\$32000	\$29000	\$17000	\$15000
<i>Less: Percentage the total bill from Medishield Life Payout</i>	35%	43%	70%	90%
<i>Less: Medisave Account Payout</i>	\$10000	\$10000	\$3500	\$3500

TABLE C: MR TAN'S ESTIMATED EXPENSES IN OCTOBER 2026	
HDB Flat Monthly Mortgage	\$400
Credit Card Minimum Payment	\$500
Miscellaneous expenditure: Food, Transport, Utilities	\$300
Mother's hospitalisation bill in cash	??

The Debt-to-Income Ratio (DTI) measures one's ability to pay for their monthly expenses. As a general guide, DTI should not exceed $\frac{7}{20}$, for one to comfortably manage their monthly expenses.

$$\text{Debt-to-Income Ratio (DTI)} = \frac{\text{Total Monthly Debt / Expenses Payments}}{\text{Gross Monthly Income}}$$

Mr Tan would like to put his mother in a ward with fewer than 8 beds.

The hospital offers a 12-month interest-free instalment plan for bill payment after the deduction of payout from Medishield Life and Medisave Account shown in Table B.

Mr Tan can choose to pay the cash portion of the hospitalisation bill via the 12-month interest-free instalment plan or pay in full.

Determine the hospitalisation ward plan Mr Tan should choose for his mother and his mode of payment. Justify your answer with mathematical calculations and state any assumptions you made.

Answer

Answer

Mr Tan should choose ward _____ and
 pay the rest of the hospitalisation bill by
 because
 Assumption:

[6]

END OF PAPER

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Answer Key

1(ai)	$p = 10$	6(a)	$\overrightarrow{AC} = -\mathbf{a} + 5\mathbf{b}$
1(aii)	$q = \frac{-pr-5r}{p-4}$ or $\frac{pr+5r}{4-p}$	6(b)	$\overrightarrow{XB} = -\frac{2}{3}\mathbf{a} + \frac{4}{3}\mathbf{b}$
1(b)	$(x-3y)(x-3)$	6(c)	$\overrightarrow{XY} = -\frac{2}{3}\mathbf{a} + \frac{10}{3}\mathbf{b}$
1(c)	$x = \frac{7}{2}$ or -1	6(d)	$2 : 3$
2(a)	$y = -\frac{3}{4}x + \frac{7}{4}$	6(e)	$\frac{4}{5}$
2(b)	15	7(b)	$\angle PSQ = 64.4^\circ$ (1dp)
2(c)	Area of triangle = 45 units ²	7(c)	$QM = 616.2078145 \approx 616$ m (3sf)
2(d)	$D(11, -14)$	7(d)	58.4° (1dp)
3(a)	$P = \begin{pmatrix} 68 & 15 & 70 \\ 72 & 0 & x \end{pmatrix}$	8(ai)	Median = 38
3(b)	$R = \begin{pmatrix} 1150 \\ 720 + 5x \end{pmatrix}$	8(aii)	$IQR = 46 - 32 = 14$
3(c)	Total amount of money collected from the sales of tickets through ticket counter and online are 1150 and $5x + 720$ respectively.	8(b)	50 seconds
3(d)	87	9(b)	Area of shaded segment = 41.9 cm^2
4(a)	$\frac{3853}{x}$	9(ci)	Volume of water $\approx 11700 \text{ cm}^3$
4(b)	$\frac{3853}{x-2}$	9(cii)	101l
4(d)	$x = -15.06$ or 17.06	10(a)	$p = 8.5$
4(e)	120 minutes	10(b)	See Graph
5(ai)	$\angle BOD = 144^\circ$	10(c)	4.5 to 5.5
5(aii)	$\angle ABD = 36^\circ$	10(dii)	$x = 1.0$ to 1.1 , 7.4 to 7.5
		11(ai)	Household monthly income per person = 2666.67 (Upper middle income)
		11(aii)	\$855

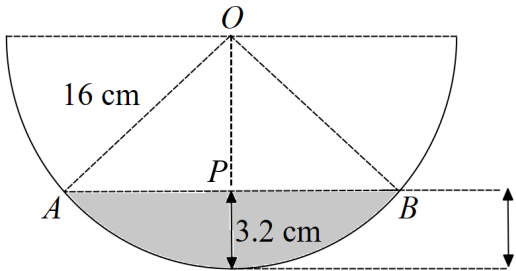
Tampines Secondary School
2026 Sec 4Exp EMath P2
Preliminary Exam Marking Scheme

No.	Mark Scheme	Marks
1(ai)	$p = \frac{4(5) - 5(-2)}{5 - 2} = 10$	B1
1(aii)	$p = \frac{4q - 5r}{q + r}$	
	$p(q + r) = 4q - 5r$ $pq - 4q = -pr - 5r$ $q = \frac{-pr - 5r}{p - 4}$ or $\frac{pr + 5r}{4 - p}$	M1 (eliminate denominator) M1 (Gp liketerms) A1
1(b)	$x^2 - 3x + 9y - 3xy = x(x - 3) + 3y(3 - x)$ $= x(x - 3) - 3y(x - 3)$ $= (x - 3y)(x - 3)$	M1 A1
1(c)	$2x^2 - 5x - 7 = 0$ $(2x - 7)(x + 1) = 0$ $x = \frac{7}{2}$ or -1	M1 o.e. A1
2(a)	$m = \frac{4 - (-5)}{-3 - 9} = -\frac{3}{4}$ Sub. $(-3, 4)$ into $y = -\frac{3}{4}x + c$ $4 = \frac{9}{4} + c$ $c = \frac{7}{4}$ $y = -\frac{3}{4}x + \frac{7}{4}$	M1 M1 A1
2(b)	$\sqrt{(-3 - 9)^2 + (4 + 5)^2} = \sqrt{225} = 15$	B1
2(c)	Area of triangle $= \frac{1}{2} \times 10 \times 9 = 45 \text{ units}^2$	B1

2(d)		B1
2(e)	$4y + 3x = 4$ $4y = -3x + 4$ $y = -\frac{3}{4}x + 1$ The line p will NOT intersect line AC, as they both have the same gradient, which means both lines are parallel.	M1 (manipulate into gradient-intercept form) A1
3(a)	$P = \begin{pmatrix} 68 & 15 & 70 \\ 72 & 0 & x \end{pmatrix}$	B1
3(b)	$PQ = \begin{pmatrix} 68 & 15 & 70 \\ 72 & 0 & x \end{pmatrix} \begin{pmatrix} 10 \\ 8 \\ 5 \end{pmatrix}$ $R = \begin{pmatrix} 1150 \\ 720 + 5x \end{pmatrix}$	M1 A1
3(c)	Total amount of money collected from the sales of tickets through ticket counter and online are 1150 and $5x + 720$ respectively.	B1
3(d)	$1150 < 5x + 720$ $x > 86$ Least value of $x = 87$	M1 A1
4(a)	$\frac{3853}{x}$	B1
4(b)	$\frac{3853}{x-2}$	B1

4(c)	$\frac{3853}{x-2} - \frac{3853}{x} = 30$ $3853x - 3853x + 7706 = 30x^2 - 60x$ $30x^2 - 60x - 7706 = 0$ $15x^2 - 30x - 3853 = 0$	M1 M1 A1
4(d)	$15x^2 - 30x - 3853 = 0$ $x = \frac{30 \pm \sqrt{30^2 - 4(15)(-3853)}}{2(15)}$ $x = -15.06 \text{ or } 17.06$	M1 A2 (minus 1 for no 2dp)
4(e)	Time taken if both taps turned on $= \frac{3853}{2x-2}$ $= \frac{3853}{2(17.06)-2}$ $= 119.95 \text{ minutes}$ $\approx 120 \text{ minutes}$	M1 A1
5(ai)	$\angle OBT = \angle ODT = 90^\circ$ (tangent $\perp$ to radius) $\angle BOD = 360 - 36 - 90 - 90$ (sum angles in a quadrilateral) $= 144^\circ$	M1 (for any tangent property, accept tangents at external point) A1
5(aii)	$\angle BAD = (360 - 144)^\circ \div 2 = 108^\circ$ ($\angle$ at centre $= 2 \times \angle$ at circumference; $\angle$ s at a point) $\angle ABD = (180 - 108)^\circ \div 2 = 36^\circ$ (Base $\angle$ s of isos. Triangle)	M1 A1
5(b)	Since $AB = AD$ (given) and $BO = OD$ (radius), hence $ABOD$ is a kite. $\angle ABO = \angle ADO = (360 - 108 - 144)^\circ \div 2 = 54^\circ$	M1 (stating $ABOD$ is kite or finding $\angle ABO$) o.e. $\triangle TBD$ is isos. (Tangents at ext. pt)
	$\angle UBA = 90 - 54 = 36^\circ$ (tangent $\perp$ to radius) Since $\angle UBA = \angle ABD$, therefore AB bisects $\angle UBD$.	B1 for $\angle UBD$
6(a)	$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$ $= -\overrightarrow{OA} + \frac{5}{2}\overrightarrow{OB}$ $= -\mathbf{a} + 5\mathbf{b}$	B1

6(b)	$\overrightarrow{XB} = \frac{2}{3} \overrightarrow{AB}$ $= \frac{2}{3} (\overrightarrow{AO} + \overrightarrow{OB})$ $= \frac{2}{3} (-\mathbf{a} + 2\mathbf{b})$ $= -\frac{2}{3} \mathbf{a} + \frac{4}{3} \mathbf{b}$	M1 B1
6(c)	Given $AXYC$ is a trapezium, $\Rightarrow XY$ and AC are parallel $\Rightarrow \triangle BXY$ and $\triangle BAC$ are similar (by AAA test) $\Rightarrow \frac{XY}{AC} = \frac{BX}{BA} = \frac{2}{3}$ $\Rightarrow \overrightarrow{XY} = \frac{2}{3} \overrightarrow{AC}$ $\Rightarrow \overrightarrow{XY} = \frac{2}{3} (-\mathbf{a} + 5\mathbf{b})$ $\Rightarrow \overrightarrow{XY} = -\frac{2}{3} \mathbf{a} + \frac{10}{3} \mathbf{b}$	M1 A1
6(d)	area of $\triangle AOB$: area of $\triangle ABC$ $= OB : BC$ (Two $\triangle$s share the same height) $= 2 : 3$	B1
6(e)	$\frac{\text{area of } \triangle BXY}{\text{area of } \triangle BAC} = \left(\frac{2}{3}\right)^2 = \frac{4}{9}$ $\Rightarrow \frac{\text{area of } \triangle BXY}{\text{area of } AXYC} = \frac{4}{9-4} = \frac{4}{5}$	B1
7(a)	$QS^2 = 300^2 + 520^2 - 2(300)(520)\cos 110^\circ$ $QS = 683.4546691 \approx 683.45467 \text{ m (shown)}$	M1 A1
7(b)	$\frac{\sin \angle PQS}{980} = \frac{\sin 42}{683.4546691}$ $\angle PQS = 73.6298309$ $\angle PSQ = 180 - 42 - 73.6298309$ $= 64.3701691$ $= 64.4^\circ$ (1dp)	M1 M1 A1
7(c)	Let M be the intersection of the perpendicular line from Q to PS, $\sin \angle PSQ = \frac{QM}{QS}$ $QM = 683.4546691 \times \sin(64.370)$ $= 616.2078145 \approx 616 \text{ m (3sf)}$	M1 ecf A1

7(d)	Let $\angle x$ be greatest angle of elevation when viewed from Q. $\tan \angle x = \frac{1000}{QM}$ $\tan \angle x = \frac{1000}{616.2078145}$ $\angle x = 58.35829991$ $\approx 58.4^\circ \text{ (1dp)}$	M1 A1
8(ai)	Median = 38	B1
8(aii)	IQR = $46 - 32 = 14$	M1 (for LQ or UQ), A1
8(b)	$80 \times 20\% = 16$ 48 seconds	M1 A1
8(c)	The median of the word puzzle is $39 >$ the median of the number puzzle, indicating that on average the adults performed better at NUMBER puzzles. The IQR of the word puzzle is 25, which is much higher than the number puzzle whose IQR is 14, hence the word puzzle solving time is more widespread and less consistent.	B1 B1
9	The diagram shows a semicircle, centre O, radius 16 cm.  Since triangle OAB is isosceles, vertical line from O to AB will be perpendicular. Let this point be P and $OP = 16 - 3.2 = 12.8 \text{ cm}$.	
9(a)	$\cos \angle AOP = \frac{12.8}{16}$ $\angle AOP = 36.86989^\circ = 0.643 \text{ 501 rad}$	M1
	$\angle AOB = 2 \times 0.643 \text{ 501}$ $= 1.287 \text{ rad. (shown)}$	A1
9(b)	Calculate the area of the shaded region. $\text{Area of sector } OAB = \frac{1}{2} \times 16^2 \times 1.287 = 164.736 \text{ cm}^2$ $\text{Area of } \triangle OAB = \frac{1}{2} \times 16^2 \times \sin 1.287 = 122.87992 \text{ cm}^2$ $\text{Area of shaded segment} = 164.736 - 122.87992 = 41.9 \text{ cm}^2$	M1 M1 A1

9(ci)	Volume of water = Segment area [Part b] $\times$ length $= 41.85608 \times 280$ $\approx 11700 \text{ cm}^3$	M1 (ecf segment) M1(length conversion to cm) A1 (Accept answer that is more than 3s.f. cm^3)
9(cii)	Volume of trough = $\left(\frac{1}{2} \times \pi \times 16^2 \times 280 \right)$ $= 112594.6807 \text{ cm}^3$ Additional water to be added = Vol of trough – Vol of water $= 112594.6807 - 11719.7024$ $= 100874.9788 \text{ cm}^3$ $= 101 \text{ l (3 s.f.)}$	M1 M1 (ecf for vol. of water) A1
10(a)	$p = 4^2 + \frac{50}{4} - 20 = 8.5$	B1
10(b)	See Graph	B1 Smooth curve B2 Correct Points
10(c)	$m = \frac{30-20}{8.3-6.3} = 5$ Accept 4.5 to 5.5	M1 for attempt to find gradient using formula A1
10(di)	$x^3 - 2x^2 - 48x + 50 = 0$ $x^2 - 2x - 48 + \frac{50}{x} = 0$ $x^2 + \frac{50}{x} - 48 = 2x$ $x^2 + \frac{50}{x} - 48 + 28 = 2x + 28$ $x^2 + \frac{50}{x} - 20 = 2x + 28$	M1 any form of correct manipulation (divide by x , minus or shifting of terms) A1
10(dii)	Draw line $x = 1.0$ to 1.1 , 7.4 to 7.5	M1 A1
11(ai)	Household monthly income per person $= \frac{\text{Total Gross Household Monthly Income}}{\text{No. of Family Members in the Household}}$ $= \frac{8000}{3}$ $= 2666.67$ (Upper middle income)	A1

11(aii)	After Initial Subsidy = $\\$1200 \times 75\% = \\900 After Merdeka Subsidy = $\\$900 \times 95\% = \\855	M1 A1
11(b)	Max expenses amount based on DTI $= \frac{7}{20} \times \\$8000 = \\2800	M1
	Max cash portion payment based on DTI $= \\$2800 - (\\$400 + \\$500 + \\$300) = \\$1600$	M1
	A ward cash payment $= (\\$32000 \times 65\% - \\$10000) \div 12 = \\$900$ B1 ward cash payment $= (\\$29000 \times 57\% - \\$10000) \div 12 = \\$544.17$ B2 ward cash payment $= (\\$17000 \times 30\% - \\$3500) \div 12 = \\$133.33$ or in full \$1600	M2 correct calculation of 3 wards with instalment Award M1 if attempt to calculate 2 wards without instalment plan for some comparison
	Mr Tan should choose ward <u>ANY WARD</u> and pay the rest of the hospitalisation bill <u>by instalment for all wards /or in full (for B2)</u> because it meets the recommended DTI ratio. Assumption: He does not have other unforeseen expenditure in the month of October. The estimated ward charges / number of days in hospital will not increase.	A1 A1 any acceptable assumption

10(b)

x	0.5	1	1.5	2	3	4	6	8
y	80.3	31	15.6	9	5.7	p	24.3	50.3

