	Class	Register Number
Name		

4052/02

MATHEMATICS

Thursday

24 August 2023

2 hours 15 minutes

23/S4PR/EM/2

PAPER 2

VICTORIA SCHOOL VICTORIA SCHOO



PRELIMINARY EXAMINATION SECONDARY FOUR

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.

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

If working is needed for any question, it must be shown with the answer. The omission of essential working will result in loss of marks. The total number of marks for this paper is 90.

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. Gives answers in degrees to one decimal place.

For π , use either your calculator value or 3.142.

Mathematical Formulae

Compound interest

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

Mensuration

Curved surface area of a cone =
$$\pi rl$$

Surface area of a sphere = $4\pi r^2$
Volume of a cone = $\frac{1}{3}\pi r^2 h$
Volume of a sphere = $\frac{4}{3}\pi r^3$
Area of triangle $ABC = \frac{1}{2}ab\sin C$
Arc length = $r\theta$, where θ is in radians
Sector area = $\frac{1}{2}r^2\theta$, where θ 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

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

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

1 (a) Given that
$$s - x = \sqrt{\frac{xy}{p} + x^2}$$
, express p in terms of s, x and y.

(b) Solve these simultaneous equations.

$$3x - 2y = 4$$
$$5x - 4y + 3 = 0$$

You must show your working.

Answer $x = \dots$

y =[3]

(c) Write $\frac{p}{3p+1} - \frac{2}{p-3}$ as a single fraction in its simplest form.

(d) Solve the equation
$$\frac{1}{2x-1} + \frac{4}{x+3} = 2$$
.

- 2 (a) It is given that Adam's monthly allowance is 130% of Bryan's and Bryan's monthly allowance is 80% of Charles'.
 - (i) Find, in its simplest form, the ratio of Adam's monthly allowance to Charles'.

(ii) If Adam's monthly allowance is \$110, find the total monthly allowance of the three boys.

(b) Dave's family had dinner at a restaurant which gave a \$10 discount and charges 10% service charge and 8% GST. The final amount they were charged on their bill was \$68.50. Find the marked price of their dinner.

Answer \$......[3]

- (c) John bought a property for \$550 000. He is required to make a down payment of 20% and simple interest of 1.5% per annum on the outstanding amount. This is followed by a series of monthly instalments over the next 30 years.
 - (i) Calculate the simple interest paid over the next 30 years.

Answer \$ [3]

(ii) Calculate the value of each instalment.

Answer \$ [2]

[Question 3 is printed on the next page]

3 (a) Complete the table of values for $y = x - 4 + \frac{10}{x+5}$.

X	-4.5	-4	-3	-1	0	1	2	3	4	
у	11.5	2	-2	-2.5	-2	-1.33		0.25	1.11	

(**b**) On the grid opposite, draw the graph of
$$y = x - 4 + \frac{10}{x+5}$$
 for $-4.5 \le x \le 4$. [3]

(c) Using your graph, find the range of values of x for which $y \le 2$.

Answer [1]

(d) By drawing a tangent, find the gradient of the curve where x = -3.

- (e) The equation $2x + \frac{10}{x+5} = 7$ can be solved by finding the points of intersection of the straight line y = ax + b and the curve $y = x 4 + \frac{10}{x+5}$.
 - (i) Find the value of *a* and of *b*.

Answer $a = \dots$

(ii) By drawing the line y = ax + b, solve the equation $2x + \frac{10}{x+5} = 7$.



4 (a) The heights of 80 pupils in School A were measured. The cumulative frequency curve below shows the distribution of their heights.



(i) Use the curve to estimate

(a) the median height,

(b) the interquartile range.

(ii) Pupils who are above a certain height will be selected to perform at the National Day Parade (NDP).The selection results revealed that 20% of the pupils were tall enough. Find the minimum height for a pupil to be selected.

- 11
- (iii) The box and whisker diagram below illustrates the heights in cm obtained from 80 pupils in School B.



Students from School B were also selected to perform at the NDP based on the same height criteria found in (a)(ii).

The newspapers reported that School B had more students performing at the NDP than School A.

Give a reason why this claim is accurate.

- (b) A performing section consists of 9 students from School A and 7 students from School B.
 - (i) Two students are selected at random, without replacement. Find, as a fraction in its simplest form, the probability that the two students are from the same school.

(ii) These two students joined back the section. Four students from School C then joined in. Three students are selected at random, without replacement. Find, as a fraction in its simplest form, the probability that two out of the three students are from School C. (a) In the diagram, lines *HK* and *IL* intersect at *J*. *GI* is parallel to *LK* and *HJ* = 2.5JK. *H* is a point on *GI*.



(iv) Find the value of $\frac{\text{area of triangle } HIJ}{\text{area of } GHKL}$.

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(b) The two circles shown below share the same centre O and have diameters 4 cm and 8 cm respectively. By leaving the answer in terms of π , find the



(i) area of the shaded region,

Answer cm² [2]

(ii) perimeter of the shaded region.

Answer cm [2]

6 (a) It is given that $\overrightarrow{AB} = \begin{pmatrix} -2\\ 5 \end{pmatrix}$ and *A* is the point (3, 7). The position vector of *D* is $\begin{pmatrix} 5\\ m \end{pmatrix}$. Find

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(i)
$$\left|\overrightarrow{AB}\right|$$
,

Answer $\left| \overrightarrow{AB} \right| =$ ______units [2]

(ii) the coordinates of B,

Answer (_____, ____) [2]

(iii) the value of *m* if \overrightarrow{OD} is parallel to \overrightarrow{AB} .

Answer $m = \dots [2]$



OABC is a quadrilateral.

 $\overrightarrow{OA} = 4\mathbf{q}$ and $\overrightarrow{OY} = 3\mathbf{p}$. *Y* is the midpoint of *OC* and *CB* = 2*OA*.

(i) Express the following vectors in terms of **p** and **q**.

(a)
$$\overrightarrow{YA}$$
,

(**b**) \overrightarrow{OB} ,

(c) \overrightarrow{AB} .

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North



ABC is a field on horizontal ground. AB = 60 m and AC = 50 m. *A* is at a bearing of 040° from *B* and *C* is at a bearing of 125° from *A*.

(a) Calculate the bearing of *B* from *A*.

Answer° [2]

(b) Find the area of triangle *ABC*.

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(c) A path is to be constructed to link *A* to *BC*. The cost of the path construction is \$85 per metre. Calculate the minimum cost to construct this path. Give your answer correct to the nearest 10 dollars.

Answer \$......[4]

(d) A tower stands at A. The angle of depression of C from the top of the tower is 33° . Find the height of the tower.



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The diagram shows a square *ABCD* with sides 50 cm. *P*, *Q*, *R* and *S* are four points on the sides *DA*, *AB*, *BC* and *CD* respectively such that AP = BQ = CR = DS. *PQRS* is also a square.

(a) When AP = x cm, the area of the square *PQRS* is 1296 cm². Form an equation, in terms of *x*, to represent this information and show that it simplifies to

$$x^2 - 50x + 602 = 0.$$
 [3]

VICTORIA SCHOOL

(b) Solve the equation $x^2 - 50x + 602 = 0$.

(c) Calculate the perimeter of the square PQRS when its area is 1296 cm².

9 All income earned and received in Singapore are subjected to income tax. The income that will be taxed is referred to as chargeable income and is given by:

Chargeable income = total gross income – total reliefs

total reliefs (amount that will not be taxed)

= personal relief+wife relief+child relief+life insurance relief+CPF contributions+donations

The table below shows the income tax rates in Singapore for Year of Assessment 2023.

	Chargeable Income (\$)	Tax Rate (%)	Gross income tax payable (\$)
On the first	20 000	0	0
On the next	10 000	2	200
On the first	30 000	-	200
On the next	10 000	3.5	350
On the first	40 000	-	550
On the next	40 000	7	2 800
On the first	80 000	-	3 350
On the next	40 000	11.5	4 600
On the first	120 000	-	7 950
On the next	40 000	15	6 000
On the first	160 000	-	13 950
On the next	40 000	18	7 200
On the first	200 000	-	21 150
On the next	40 000	19	7 600
On the first	240 000	-	28 750
On the next	40 000	19.5	7 800
On the first	280 000	-	36 550
On the next	40 000	20	8 000
On the first	320 000	-	44 550
In excess of	320 000	22	

(a) Mr Neo paid \$7030 for his income tax. He is eligible for a personal relief of \$4000, a wife relief of \$2000 and a child relief of \$4000. His CPF contributions amounted to \$26 000 and he donated \$2000 to charitable organisations. Calculate his gross annual income.

(b) Mdm Lau earned a gross annual income of \$188 000. She is eligible for a personal relief of \$4000 and a parent relief of \$9000. She has 2 children. She is entitled to a relief of 15% of her gross income for her first child and a relief of 20% of her gross income for her second child. Her CPF contributions amounted to \$33 600. Calculate her income tax payable.

Answer \$.....[3]

End of Paper

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1.		C	ass	Register Number
Name	Solutions			
4052/02				23/S4PR/EM/2
MATHEM	ATICS			PAPER 2
Thursday		24 August 2023		2 hours 15 minutes
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For π , use either your calculator value or 3.142.

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Arc length = $r\theta$, where θ is in radians
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Statistics

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

1 (a) Given that $s - x = \sqrt{\frac{xy}{p} + x^2}$, express p in terms of s, x and y.

$$s - x = \sqrt{\frac{xy}{p} + x^2}$$
$$(s - x)^2 = \frac{xy}{p} + x^2$$
$$s^2 - 2sx + x^2 = \frac{xy}{p} + x^2$$
$$s^2 - 2sx = \frac{xy}{p}$$
$$p(s^2 - 2sx) = xy$$
$$p = \frac{xy}{s^2 - 2sx}$$
$$= \frac{xy}{s(s - 2x)}$$

Answer
$$p = \dots \frac{xy}{s(s-2x)}$$
 [2]

(b) Solve these simultaneous equations.

$$3x - 2y = 4$$
$$5x - 4y + 3 = 0$$

You must show your working.

$$3x-2y = 4 \dots (1)$$

$$5x-4y+3 = 0 \dots (2)$$

from (2): $5x-4y = -3 \dots (3)$
(1)×2: $6x-4y = 8 \dots (4)$
(4)-(3): $x = 11 \dots (5)$
Subst (5) into (1),
from (1): $33-2y = 4$
 $y = 14.5$
 $\therefore x = 11, y = 14.5$

Answer $x = \dots 11$ $y = \dots 14.5$ [3] (c) Write $\frac{p}{3p+1} - \frac{2}{p-3}$ as a single fraction in its simplest form.

$$\frac{p}{3p+1} - \frac{2}{p-3} = \frac{p(p-3) - 2(3p+1)}{(p-3)(3p+1)}$$
$$= \frac{p^2 - 3p - 6p - 2}{(p-3)(3p+1)}$$
$$= \frac{p^2 - 9p - 2}{(p-3)(3p+1)}$$

(d) Solve the equation
$$\frac{1}{2x-1} + \frac{4}{x+3} = 2$$
.

$$\frac{1}{2x-1} + \frac{4}{x+3} = 2$$

x+3+4(2x-1) = 2(2x-1)(x+3)
4x² + x-5 = 0
(4x+5)(x-1) = 0
x = -1\frac{1}{4} or x = 1

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

- 2 (a) It is given that Adam's monthly allowance is 130% of Bryan's and Bryan's monthly allowance is 80% of Charles'.
 - (i) Find, in its simplest form, the ratio of Adam's monthly allowance to Charles'.

Let Charles' monthly allowance be \$x.

Adam: Charles =1.3(0.8x): x = 1.04:1 = 26:25

(ii) If Adam's monthly allowance is \$110, find the total monthly allowance of the three boys.

Total monthly allowance

$$=\frac{\$110}{26} \times (26 + 20 + 25)$$
$$=\frac{\$110}{26} \times (71)$$
$$=\$300.38 (2 \text{ d.p.})$$

(b) Dave's family had dinner at a restaurant which gave a \$10 discount and charges 10% service charge and 8% GST. The final amount they were charged on their bill was \$68.50. Find the marked price of their dinner.

Marked price of meal = $\left[\frac{\$68.50}{1.10 \times 1.08}\right] + \10 $\approx \$67.66$

- (c) John bought a property for \$550 000. He is required to make a down payment of 20% and simple interest of 1.5% per annum on the outstanding amount. This is followed by a series of monthly instalments over the next 30 years.
 - (i) Calculate the simple interest paid over the next 30 years.

Outstanding amount = 550 000 × $\frac{80}{100}$ = \$440 000 Simple interest = $\frac{440\ 000 \times 1.5 \times 30}{100}$ = \$198 000

(ii) Calculate the value of each instalment.

Value of each instalment = $\frac{440\ 000 + 198\ 000}{30(12)}$ = \$1772.22 (2 d.p.)

[Question 3 is printed on the next page]

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3 (a) Complete the table of values for $y = x - 4 + \frac{10}{x+5}$.

X	-4.5	-4	-3	-1	0	1	2	3	4	
У	11.5	2	-2	-2.5	-2	-1.33	<u>-0.571</u>	0.25	1.11	

(**b**) On the grid opposite, draw the graph of
$$y = x - 4 + \frac{10}{x+5}$$
 for $-4.5 \le x \le 4$. [3]

(c) Using your graph, find the range of values of x for which $y \le 2$.

 $-4 \le x \le 4$ [1]

(d) By drawing a tangent, find the gradient of the curve where x = -3.

(e) The equation $2x + \frac{10}{x+5} = 7$ can be solved by finding the points of intersection of the straight line y = ax+b and the curve $y = x-4 + \frac{10}{x+5}$.

(i) Find the value of *a* and of *b*.

$$2x + \frac{10}{x+5} = 7$$

$$2x - x - 4 + \frac{10}{x+5} = 7 - x - 4$$

$$x - 4 + \frac{10}{x+5} = -x + 3$$

Answer $a = \dots -1$

(ii) By drawing the line y = ax + b, solve the equation $2x + \frac{10}{x+5} = 7$.

Answer x = -4.35 or 2.85 [3]



4 (a) The heights of 80 pupils in School A were measured. The cumulative frequency curve below shows the distribution of their heights.



(ii) Pupils who are above a certain height will be selected to perform at the National Day Parade (NDP).The selection results revealed that 20% of the pupils were tall enough. Find the minimum height for a pupil to be selected.

No. of students not selected = $\frac{80}{100} \times 80$

∴ The minimum height is 125.5 cm.

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(iii) The box and whisker diagram below illustrates the heights in cm obtained from 80 pupils in School B.



Students from School B were also selected to perform at the NDP based on the same height criteria found in (a)(ii).

The newspapers reported that School B had more students performing at the NDP than School A.

Give a reason why this claim is accurate.

 There are more than 25% of students in School B who are above the 125.5 cm height criteria.

 [1]
 [1]

- (b) A performing section consists of 9 students from School A and 7 students from School B.
 - (i) Two students are selected at random, without replacement. Find, as a fraction in its simplest form, the probability that the two students are from the same school.

Probability =
$$\frac{9}{16} \times \frac{8}{15} + \frac{7}{16} \times \frac{6}{15}$$

= $\frac{19}{40}$

 $\frac{\frac{19}{40}}{Answer}$ [2]

(ii) These two students joined back the section.
 Four students from School C then joined in.
 Three students are selected at random, without replacement.
 Find, as a fraction in its simplest form, the probability that two out of the three students are from School C.

Probability =
$$\frac{4}{20} \times \frac{3}{19} \times \frac{16}{18} \times 3$$

= $\frac{8}{95}$

(a) In the diagram, lines *HK* and *IL* intersect at *J*. *GI* is parallel to *LK* and *HJ* = 2.5JK. *H* is a point on *GI*.



- (i) Prove a pair of similar triangles. $\angle LJK = \angle IJH$ (vert. opp. $\angle s$) $\angle JLK = \angle JIH$ (alt. $\angle s$, LK//HI) Hence, ΔLJK is similar to ΔIJH .
- (ii) Given that angle LGH = angle LKJ, prove that GL is parallel to HK. $\angle JHI = \angle JKL$ (alt. $\angle s$, LK / /GI) $\angle JKL = \angle LGH$ (given) $\angle JHI = \angle LGH$ [2]

By angle property of corresponding angles, GL is parallel to HK.

[2]

The two circles shown below share the same centre O and have diameters **(b)** 4 cm and 8 cm respectively. By leaving the answer in terms of π , find the



Answer 13π cm^2 [2]

(ii) perimeter of the shaded region.

Perimeter of the shaded region

$$= \pi(8) + \frac{3}{4}\pi(4) + 4$$

= $8\pi + 3\pi + 4$
= $(11\pi + 4)$ cm

 $=\pi(4)^2 - \frac{3}{4}\pi(2)^2$

 $=16\pi - 3\pi$ $=13\pi$ cm²

(i)

Answer $(11\pi + 4)$ cm [2]

6 (a) It is given that $\overrightarrow{AB} = \begin{pmatrix} -2\\ 5 \end{pmatrix}$ and *A* is the point (3, 7). The position vector of *D* is $\begin{pmatrix} 5\\ m \end{pmatrix}$. Find (i) $|\overrightarrow{AB}|$, $|\overrightarrow{AB}| = \sqrt{(-2)^2 + 5^2}$ $= \sqrt{29}$ ≈ 5.385 ≈ 5.39 units

Answer $\left| \overrightarrow{AB} \right| = 5.39$ units [2]

(ii) the coordinates of B,

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$$
$$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$$
$$= \begin{pmatrix} 3\\7 \end{pmatrix} + \begin{pmatrix} -2\\5 \end{pmatrix}$$
$$= \begin{pmatrix} 1\\12 \end{pmatrix}$$
$$\therefore B(1, 12)$$

Answer (_____1 ____, ____12 ____) [2]

(iii) the value of *m* if \overrightarrow{OD} is parallel to \overrightarrow{AB} .

$$\overrightarrow{OD} = k \overrightarrow{AB} \text{ where } k \text{ is a constant}$$

$$\binom{5}{m} = k \binom{-2}{5}$$

$$-2k = 5 \dots (1)$$

$$5k = m \dots (2)$$

$$\binom{2}{(1)} : \frac{5}{-2} = \frac{m}{5}$$

$$\therefore m = -12\frac{1}{2}$$

$$-12\frac{1}{2}$$

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

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OABC is a quadrilateral.

 $\overrightarrow{OA} = 4\mathbf{q}$ and $\overrightarrow{OY} = 3\mathbf{p}$. *Y* is the midpoint of *OC* and *CB* = 2*OA*.

(i) Express the following vectors in terms of **p** and **q**.

(a)
$$\overrightarrow{YA}$$
,
 $\overrightarrow{YA} = \overrightarrow{OA} - \overrightarrow{OY}$
 $= 4\mathbf{q} - 3\mathbf{p}$

Answer $\overrightarrow{YA} = \dots 4\mathbf{q} - 3\mathbf{p}$ [1]

(**b**) \overrightarrow{OB} ,

$$\overrightarrow{OB} = \overrightarrow{OC} + \overrightarrow{CB}$$
$$= 2\overrightarrow{OY} + 2\overrightarrow{OA}$$
$$= 2(3\mathbf{p} + 4\mathbf{q})$$

Answer $\overrightarrow{OB} = \dots$ [1]

(c) \overrightarrow{AB} .

$$\overrightarrow{AB} = \overrightarrow{OB} - \overrightarrow{OA}$$

$$= 2(3\mathbf{p} + 4\mathbf{q}) - 4\mathbf{q}$$

$$= 6\mathbf{p} + 4\mathbf{q}$$

$$= 2(3\mathbf{p} + 2\mathbf{q})$$

$$2(3\mathbf{p} + 2\mathbf{q})$$

$$11$$

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(c) Calculate the value of $\frac{\text{area of } \Delta OBC}{\text{area of quadrilateral } OABC}$.

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Since $\triangle OAB$ and $\triangle OBC$ share a common height,

 $\frac{\text{area of } \Delta OAB}{\text{area of } \Delta OBC} = \frac{OA}{CB} = \frac{1}{2}$

$$\therefore \frac{\text{area of } \triangle OBC}{\text{area of quadrilateral } OABC} = \frac{2}{1+2}$$
$$= \frac{2}{3}$$

 $\frac{2}{3}$ [2]

North Calculate the bearing of *B* from *A*. **(a)** $\angle BAN = 40^{\circ}$ (Alt. $\angle s$, Parallel North lines) A 1259 North \therefore Bearing of *B* from $A = 180^\circ + 40^\circ$ 50 60 = 40 N 220 Answer • [2]

(b) Find the area of triangle *ABC*.

ABC is a field on horizontal ground.

AB = 60 m and AC = 50 m.

$$\angle NAC = 180^{\circ} - 125^{\circ} \text{ (adj } \angle \text{s on a str. line)}$$

= 55°
 $\therefore \angle BAC = 40^{\circ} + 55^{\circ}$
= 95°
Area $\triangle ABC = \frac{1}{2}(60)(50) \sin 95^{\circ}$
= 1494.292
= 1490 m² (3 SF)



A is at a bearing of 040° from B and C is at a bearing of 125° from A.

(c) A path is to be constructed to link *A* to *BC*. The cost of the path construction is \$85 per metre. Calculate the minimum cost to construct this path. Give your answer correct to the nearest 10 dollars.

Let T be the foot of perpendicular from A to BC.

$$BC^{2} = 60^{2} + 50^{2} - 2(50)(60)\cos 95^{\circ}$$

$$\Rightarrow BC = 81.381$$

$$\therefore \frac{1}{2}(BC)(AT) = 1494.292$$

$$\frac{1}{2}(81.381)(AT) = 1494.292$$

$$AT = 36.723$$



 \therefore The minimum cost to construct the path = $\$85 \times 36.723$

$$=$$
 \$3120 (nearest \$10)

(d) A tower stands at A. The angle of depression of C from the top of the tower is 33° . Find the height of the tower.

Let h be the height of the tower.

 $\tan 33^\circ = \frac{h}{50}$ $\therefore h = 32.47037$ $\approx 32.5 \text{ m}$



20

The diagram shows a square *ABCD* with sides 50 cm. P, Q, R and S are four points on the sides DA, AB, BC and CD respectively such that AP = BQ = CR = DS.PQRS is also a square.

When AP = x cm, the area of the square *PQRS* is 1296 cm². **(a)** Form an equation, in terms of *x*, to represent this information and show that it simplifies to

$$x^2 - 50x + 602 = 0.$$
 [3]

PD = (50 - x)
∴ Area of square PQRS,
$$1296 = x^2 + (50 - x)^2$$

 $1296 = x^2 + 2500 - 100x + x^2$
 $1296 = 2x^2 - 100x + 2500$
 $2x^2 - 100x + 1204 = 0$
 $\Rightarrow x^2 - 50x + 602 = 0$ (Shown)

Alternative Method:

/

$$PD = (50 - x)$$

∴ Area of square PQRS, $1296 = 50^2 - 4\left[\frac{1}{2}x(50 - x)\right]$
 $1296 = 2500 - 2(50x - x^2)$
 $1296 = 2500 - 100x + 2x^2$
 $2x^2 - 100x + 1204 = 0$
 $\Rightarrow x^2 - 50x + 602 = 0$ (Shown)

(b) Solve the equation $x^2 - 50x + 602 = 0$.

$$x = \frac{-(-50) \pm \sqrt{(-50)^2 - 4(1)(602)}}{2(1)}$$
$$= \frac{50 \pm \sqrt{92}}{2}$$
$$\approx 20.204 \text{ or } 29.796$$
$$\approx 20.2 \text{ or } 29.8$$

(c) Calculate the perimeter of the square PQRS when its area is 1296 cm².

Perimeter of $PQRS = 4 \times \sqrt{20.204^2 + 29.796^2}$ ≈ 144.00 $\approx 144 \text{ cm}$

- 22
- 9 All income earned and received in Singapore are subjected to income tax. The income that will be taxed is referred to as chargeable income and is given by:

Chargeable income = total gross income – total reliefs

total reliefs (amount that will not be taxed)

= personal relief+wife relief+parent relief+child relief+life insurance relief+CPF contributions+donations

	Chargeable Income (\$)	Tax Rate (%)	Gross income tax payable (\$)
On the first	20 000	0	0
On the next	10 000	2	200
On the first	30 000	-	200
On the next	10 000	3.5	350
On the first	40 000	-	550
On the next	40 000	7	2 800
On the first	80 000	-	3 350
On the next	40 000	11.5	4 600
On the first	120 000	-	7 950
On the next	40 000	15	6 000
On the first	160 000	-	13 950
On the next	40 000	18	7 200
On the first	200 000	-	21 150
On the next	40 000	19	7 600
On the first	240 000	-	28 750
On the next	40 000	19.5	7 800
On the first	280 000	-	36 550
On the next	40 000	20	8 000
On the first	320 000	-	44 550
In excess of	320 000	22	

The table below shows the income tax rates in Singapore for Year of Assessment 2023.

(a) Mr Neo paid \$7030 for his income tax. He is eligible for a personal relief of \$4000, a wife relief of \$2000 and a child relief of \$4000. His CPF contributions amounted to \$26 000 and he donated \$2000 to charitable organisations. Calculate his gross annual income.

Total reliefs = $4000 + 2000 + 4000 + 26\ 000 + 2000$ = \$38\ 000 ∴ Income tax payable = $3350 + (\frac{11.5}{100} \times 32\ 000)$ = \$7030 gross annual income = $32\ 000 + 80\ 000 + 38\ 000$ = \$150\ 000 Alternative Method:

Let gross annual annual income be x.

(b) Mdm Lau earned a gross annual income of \$188 000. She is eligible for a personal relief of \$4000 and a parent relief of \$9000. She has 2 children. She is entitled to a relief of 15% of her gross income for her first child and a relief of 20% of her gross income for her second child. Her CPF contributions amounted to \$33 600. Calculate her income tax payable.

Total reliefs = $4000 + 9000 + 0.15(188\ 000) + 0.2(188\ 000) + 33\ 600$ = \$112\ 400 Chargeable income = 188\ 000 - 112\ 400 = \$75\ 600 ∴ Income tax payable = 550 + (0.07 × 35\ 600) = \$3042

> \$3042 Answer.....[3]

End of Paper

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