SERANGOON GARDEN SECONDARY SCHOOL

Vision: **Learners with Grit, Leaders with Heart**
Mission: **Nurturing and empowering individuals to lead purposeful lives**

PRELIMINARY EXAMINATION 2021

CANDIDATE NAME			
CLASS		**REGISTER NUMBER**	

MATHEMATICS **4048/01**
Paper 1 **20 August 2021**
Secondary 4 Express/ 5 Normal Academic **2 hours**
1030 - 1230

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and class 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, highlighters, 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 80.

_____ Name/Signature of Parent/Guardian _____ Date	**FOR MARKER'S USE** **80**

This question paper consists of 19 printed pages and 1 blank page.

Setter: Ms Tay HY **Vetter: Mr Poh Wei Ren**

Mathematical Formulae

Compound interest

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

Mensuration

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

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

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

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

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

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

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

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 $\frac{1.98^2 \times \sqrt[3]{31.2}}{3.41 - 2.2}$.
Write down the first five digits of your answer.

Answer ……..……. [1]

(b) Correct your answer in **part (a)** to 3 significant figures.

Answer ……..……. [1]

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2 In Singapore, Leon pays S$1.98 for one litre of petrol.
On a self-drive holiday to Los Angeles, he paid US$5.40 for a gallon of petrol.
The information is given below.

1 US dollar = 1.33 Singapore dollars.
1 gallon = 3.79 litres.

Determine if petrol was cheaper in Singapore or Los Angeles?
Show your calculations clearly.

Answer …….

……..

……..

……..

……..

……..

…….. [2]

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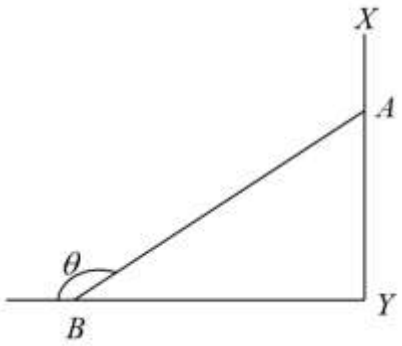
3 The diagram shows a ladder, AB, leaning against a vertical wall, AY.



Given that $\sin\theta = \frac{4}{5}$, express as a fraction, the value of

(a) $\sin\angle ABY$,

Answer ……..……. [1]

(b) $\cos\angle XAB$.

Answer ……..……. [1]

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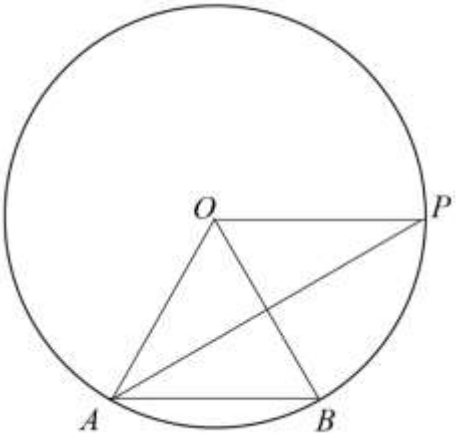
4 At full capacity, a power plant can produce 510 gigawatts of energy annually. In 2020, it did not operate at full capacity and produced only 85% of its annual output.
Find the amount of energy produced in 2020 by the power plant, given that

1 gigawatt $= 10^9$ watts, expressing your answer in standard form.

Answer ……..……. watts [2]

[Turn over

5 *AB* is a chord of a circle whose centre is *O*. The bisector of the angle *OAB* meets the circumference of the circle at *P*. Prove that *OP* is parallel to *AB*.



Answer ……

……..

……..

……..

……..

…….. [2]

6 The length of two sides of a triangle is 2.5 and 3 times of the length of the shortest side respectively. Find the size of the largest angle in the triangle.

Answer …… ° [3]

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7 A map is drawn to a scale of 1: 50 000.

(a) Two towns are 12 cm apart on the map. Find the actual distance between the towns.

Answer ……..……. km [1]

(b) A theme park on the map has an actual area of 18 km^2. Calculate its area represented on the map.

Answer ……..……. cm^2 [2]

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8 A submarine is 380 m below sea level and a helicopter hovering 240 m above sea level is directly above it.

(a) Find the vertical distance between the submarine and the helicopter.

Answer……..…… m [1]

(b) A diver swimming in the sea is exactly midway between the helicopter and the submarine. Given that the sea bed is 565m deep, find the distance between the diver and the sea bed.

[Turn over

Answer……..…… m [1]

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9 **(a)** Written as a product of its prime factors, $10206 = 2 \times 3^6 \times 7$.

Find the smallest positive integer p such that $\frac{10206}{p}$ is a cube number.

Answer $p =$ ……..…… [1]

(b) It is given that $x = 2^4 \times 3 \times 5^2$ and $y = 2^2 \times 7^{4k}$ where k is a positive integer.

(i) Find, as product of prime factors and in terms of k, the lowest common multiple of x and y.

Answer ……..…….……..……. [1]

(ii) Justify whether y is a perfect square.

Answer ……..……..……..

……..……..

……..… [1]

---

10 **(a)** Express $11 - 6x + x^2$ in the form $p + (x + q)^2$.

Answer ……..……. [2]

(b) Write down the coordinates of the minimum point of the graph of $y = 11 - 6x + x^2$

Answer (…… , ……..……) [1]

(c) Explain why the graph will not cut the x-axis.

Answer ……..

……..

…….. [1]

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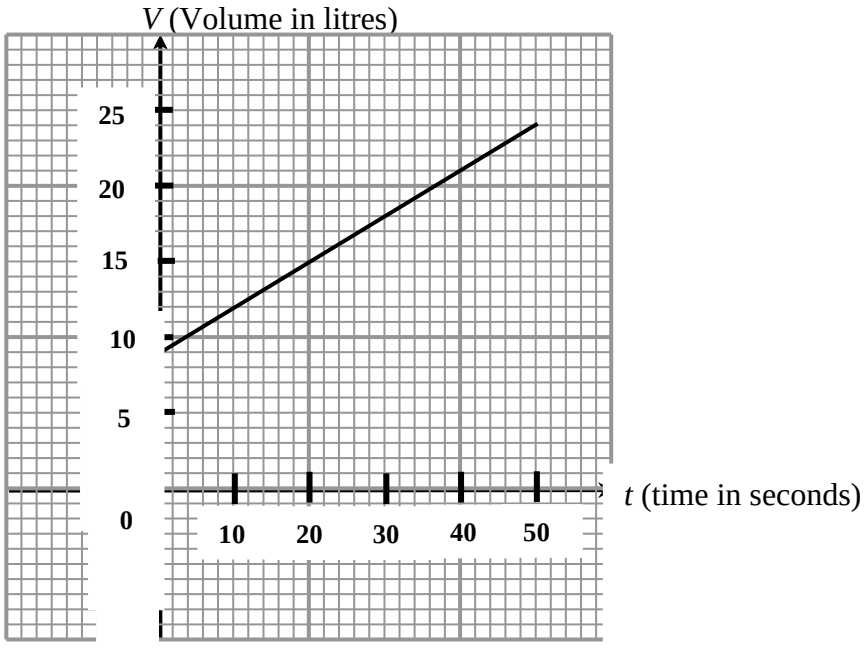
11 Water is being pumped into a cylindrical tank at a constant rate.
The graph below shows how the volume of water in the tank changes as a further 15 litres of water is pumped for 50 seconds.



(a) State the initial amount of water in the cylindrical tank.

Answer …… litres [1]

(b) Find the equation of the straight line in terms of V and t .

Answer $V =$ …….. [2]

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12 Mr Tan is the owner of an electronic shop and he offered a 30% discount on all items in his shop during Black Friday. Three days later, on Cyber Monday, Mr Tan offered a further

[Turn over

30% discount on the sale price of a washing machine on Black Friday.

(a) Jamie paid \$1274 for the washing machine on Cyber Monday. Find the original price of the washing machine before the two sales.

Answer \$ ……..……. [2]

(b) Jamie told his father that he was given a 60% discount for buying the washing machine. Explain with clear working whether Jamie is correct.

Answer ……..……..

……

……

……..

……..

……..

…….. [2]

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13 **(a)** $\mathscr{E}$ = { integers x: $0 \leq x < 12$}

A = {prime numbers}

B = {integers x: $2x + 3 > 5$}

(i) Draw a Venn diagram to illustrate this information.

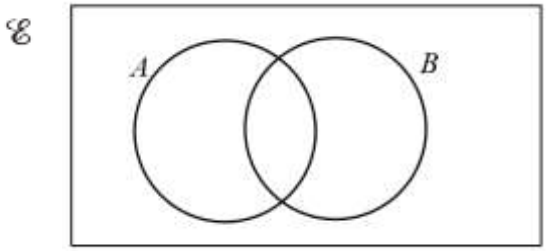
Answer

[2]

(ii) Write down n($A' \cap B$).

Answer …… [1]

(b) On the Venn diagram, shade the region which represents $(A \cup B)'$.



[1]

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14 (a) Simplify $4a(3-2b)+5ba+a$.

Answer ……..…… [2]

(b) Factorise completely $4fx-4gy+gx-16fy$.

Answer ……..…… [2]

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15 Solve the following equations.

(a) $(x+3)(3x+2)-(x+3)^2=0$

Answer $x =$…….. or $x =$…….. [2]

(b) $2 - \frac{3}{x} = 6$

Answer $x =$…….. [2]

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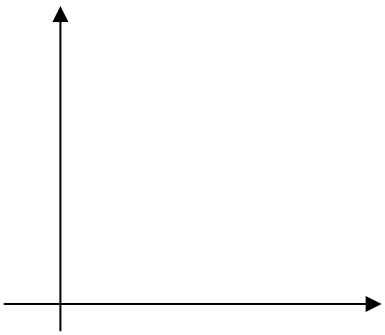
16 The pressure, P, of a particle, is inversely proportional to the square of its radius, r.

(a) Sketch the graph of pressure against radius for the particle.



[1]

When the radius of the particle is y cm, the pressure is 54 N/cm^2.
Then there is a 50% increase in the radius.

(b)

(i) Write down an expression, in terms of y, for the new radius.

Answer ……..…….. [1]

(ii) Find the new pressure after the increase in the radius.

Answer …….. N/cm^2 [2]

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17 The ordered stem-and-leaf diagram shows the distribution of the weights, in kilograms, of 16 students.
The median and range of the distribution are 74.5 kg and 22 kg respectively.

6		8	8	8	9		
7	a 0	2	3	b	8	8	9
8	2	4	5	5			

(a) Find the value of a and b,

Answer $a =$ …….. ; $b =$ …….. [2]

(b) interquartile range of the distribution.

[Turn over

Answer ……..……. [1]

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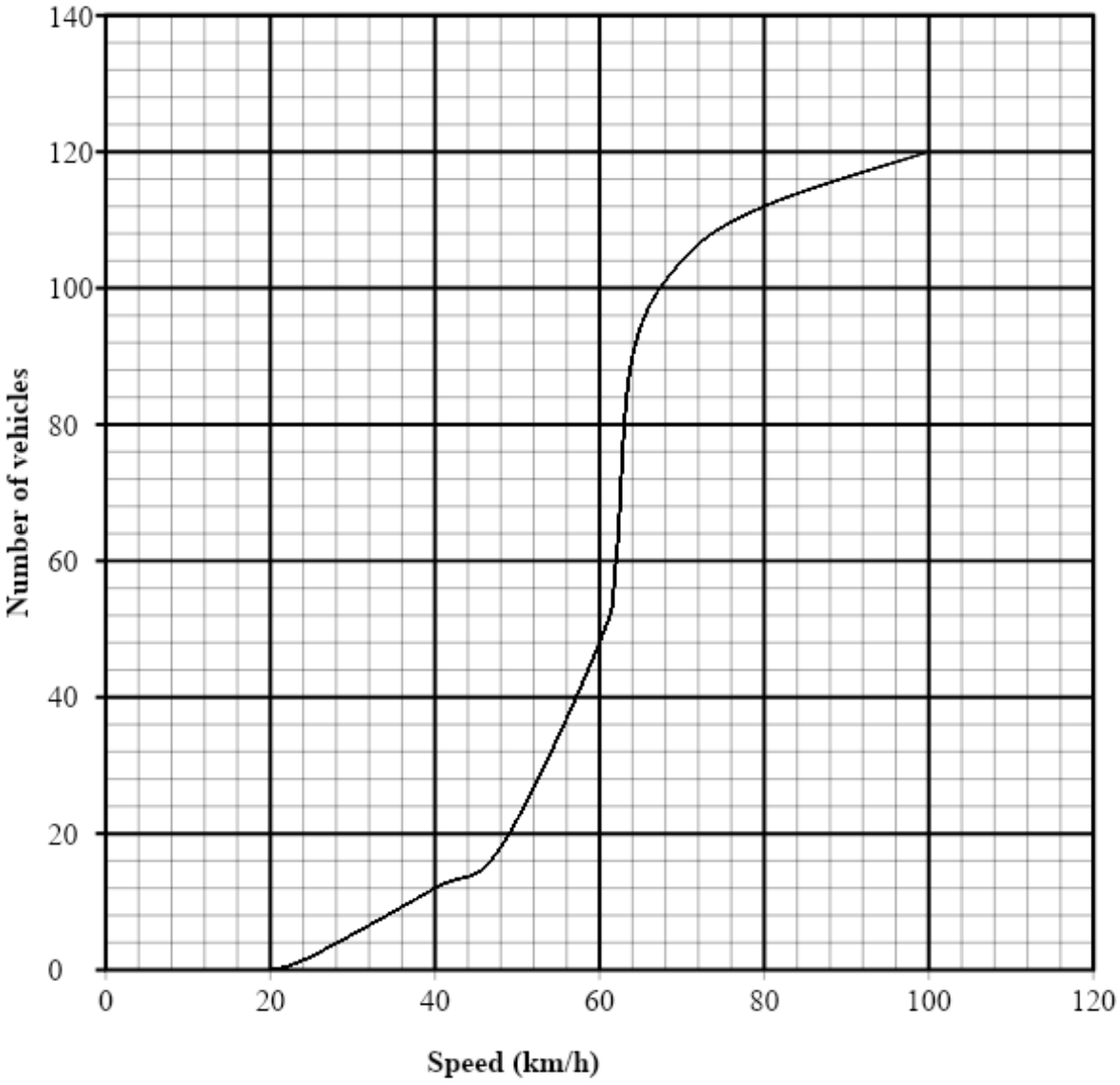
18 The cumulative frequency graph shows the speed of 120 vehicles passing by a road within 15 minutes.



(a) Use the graph to find the median speed.

Answer ……. km/h [1]

(b) The maximum speed allowed on this road is 70 km/h. Find the fraction of vehicles that will be fined for speeding as they exceeded the maximum speed.

Answer ……. [1]

(c) The cumulative frequency curve can be represented by the following frequency table.

Speed, x km/h	Number of cars

[Turn over

$20 \leq x < 40$	12
$40 \leq x < 60$	36
$60 \leq x < 80$	64
$80 \leq x < 100$	g

(i) Find the value of g.

Answer g = ... [1]

(ii) Calculate the standard deviation.

Answer ..... km/h [1]

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19 (a) Keith invests \$8000 in a bank that pays 4% interest per annum compounded half yearly. Calculate the amount of interest Keith will earn at the end of 3 years.

Answer \$..... [2]

(b) A company offers 2 different schemes for annual pay increment to its employees. Linda, Pamela and Hafiz are employees of this company.
Scheme A: Pay rise of 15% of present annual pay
Scheme B: Pay rise of \$936 plus 12% of present annual pay
Linda finds that both schemes give her the same amount of annual pay increment.

(i) Find the monthly pay received by Linda currently.

Answer \$..... [2]

(ii) Pamela finds that scheme A gives her more pay increment, whereas Hafiz finds that scheme B gives him more pay increment. Explain why this is so.

Answer ……..……..

…… [1]

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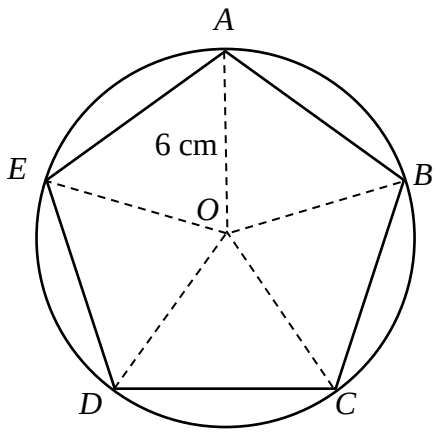
20 In the diagram, vertices of a regular pentagon are *A*, *B*, *C*, *D* and *E* which lie on the circumference of the circle with centre *O*.



(a) Find $\angle AOB$, giving your answer in terms of π.

Answer …… radian [1]

(b) Given that the radius of the circle is 6 cm, find the area of the shaded region.

Answer ……..… cm^2 [4]

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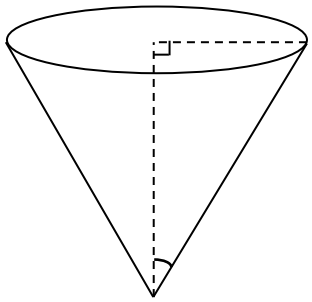
21 The diagram shows a paper cup in the shape of a cone of height h cm.



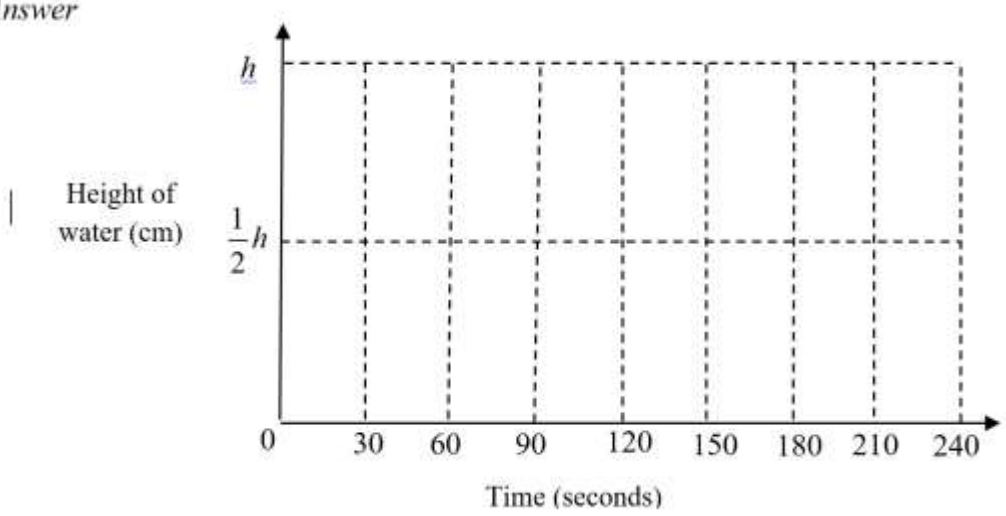
(a) **(i)** It takes 4 minutes to completely fill the cup with water from a dripping tap.

Find the time taken, in seconds, for the cup to be filled to a height of $\frac{1}{2}h$ cm.

Answer ……..…….… seconds [1]

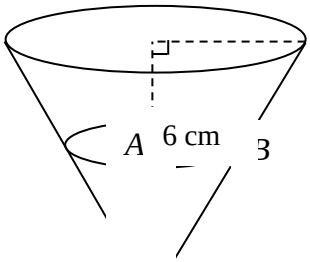
(ii) On the axes in the answer space, sketch the graph showing how the height of the water in the cup will change over the 4 minutes.

Answer



[1]

(b) The cup is filled partially with water. The slant height of the cone makes an angle of 20° with the vertical height and AB is 6 cm.
Find the surface area of the cup that is in contact with water.



[Turn over

Answer ……..…..… cm^2 [3]

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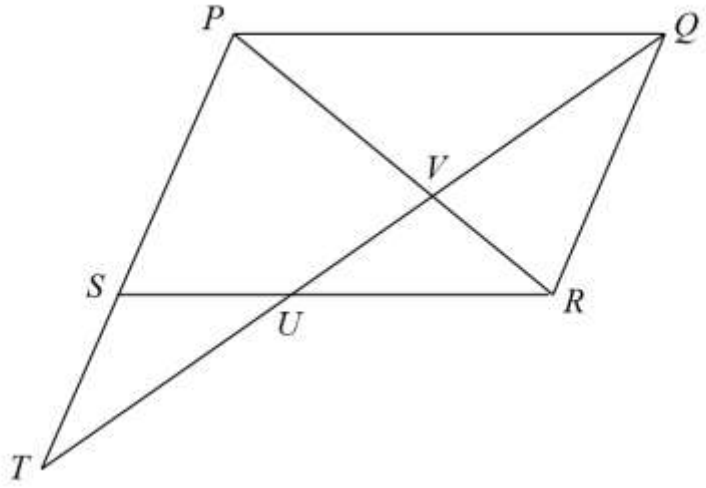
22 The diagram below shows a parallelogram $PQRS$. PS and QU are produced to meet at T. QT cuts PR and SR at V and U respectively.



(a) Show that triangles STU and PTQ are similar.

Answer …….

……..

……..

……..

…….. [2]

(b) State the triangle that is similar to ΔQVP.

Answer Δ ……. [1]

(c) Given that $3PQ = 5RU$, find

(i) area of ΔTSU : area of ΔTPQ

Answer …… : ..……. [1]

(ii) area of quadrilateral $SUQP$ when area of ΔTSU is 8 cm^2.

Answer …….…….. cm^2 [1]

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23 The scale drawing in the answer space below shows the positions of the islands A, B, and C with A due north of B. It uses a scale of 1 cm to represent 5 km.

(a) Another island D is on a bearing of 035° from C and 50 km from B. Using construction, find and label the position of island D. [2]

(b) Given that a floating platform, P, is to be built such that it is equidistant from A and B as well as equidistant from AB and BC, using construction, find and label the position of the floating platform. [2]

Answer for **(a)** and **(b)**

(c) Find the actual distance of P from A.

Answer ……..…..… km [1]

END OF PAPER