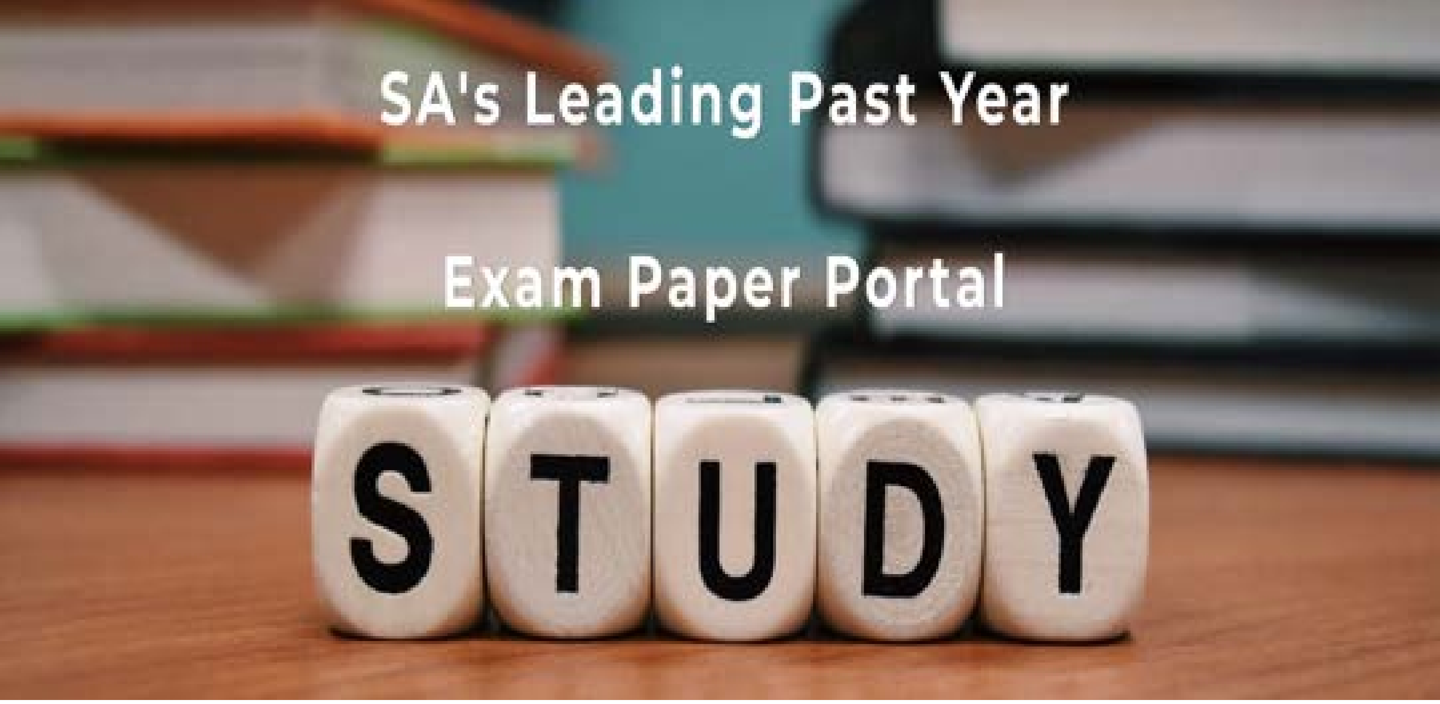

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GRADE 12

MATHEMATICS

Date: 13 April 2021

Time: 2 hours **Marks: 100**

Instructions:

Read the following instructions carefully before answering the questions.

- **This question paper consists of 7 questions in Section A and one question in Section B**
- Answer ALL the questions in **SECTION A** and **SECTION B** is optional.
- Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
- Answers only will not necessarily be awarded full marks.
- You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
- If necessary, round off answers to TWO decimal places, unless stated otherwise.

- Diagrams are NOT necessarily drawn to scale.
- An information sheet, with formulae, is included at the end of the question paper.
- THE diagram sheet that is included at the end of the paper must be handed in with your test, with construction lines added to the diagrams where necessary.
- Number the answers correctly according to the numbering system used in this question paper.
- Write legibly and present your work neatly.

SECTION A

QUESTION 1

Given the sequence –5; 4; 21; 46; ……

1.1 Determine the general term of the above sequence. (4)

1.2 Determine T_{15} (1)

1.3 Which term in the sequence will be equal to 364? (3)

[8]

QUESTION 2

2.1 $\sum_{i=2}^{m} 32(2)^{5-i} < 500$

2.1.1 Determine the value of m for which the above-mentioned statement is true, by using the correct sum formula. (4)

2.1.2 Determine the value for $S_\infty - S_4$ (3)

[7]

QUESTION 3

$2x;\ x+1;\ 6-x;\ ...$ are the first three (3) terms of an arithmetic sequence.

3.1 Determine the value for x. (2)

3.2 If $x = 4$, how many terms in the sequence add up to -575. (4)

[6]

QUESTION 4

The sum of the first n terms of a series is given by : $S_n = \frac{n}{8}(14-4n)$

4.1 Determine the sum of the first 25 terms of this series. (1)

4.2 Determine the value of term 25. (3)

4.3 Determine the general term of the series (5)

[9]

Question 5

5.1 If $\cos 26^{\circ} = q$, write the following in terms of p:

5.1.1 $\cos 334^{\circ}$ (1)

5.1.2 $\sin 52^{\circ}$ (3)

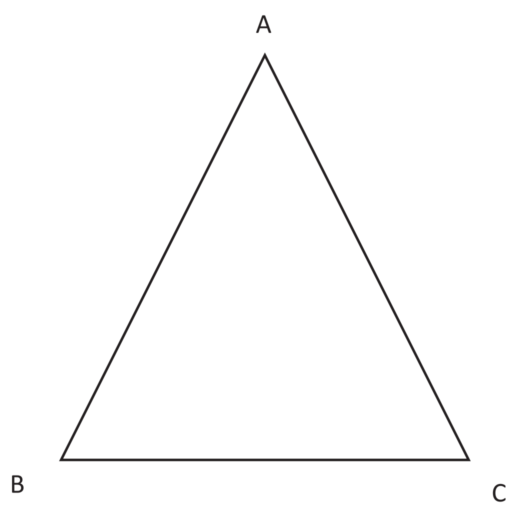
5.1.3 $\sin 86^{\circ}$ (2)

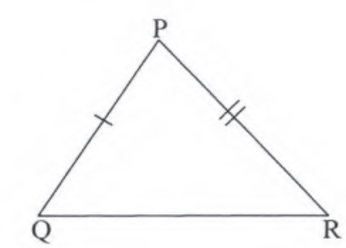
[6]

Question 6

6.1 Given in the diagram below ΔABC and ΔPQR with

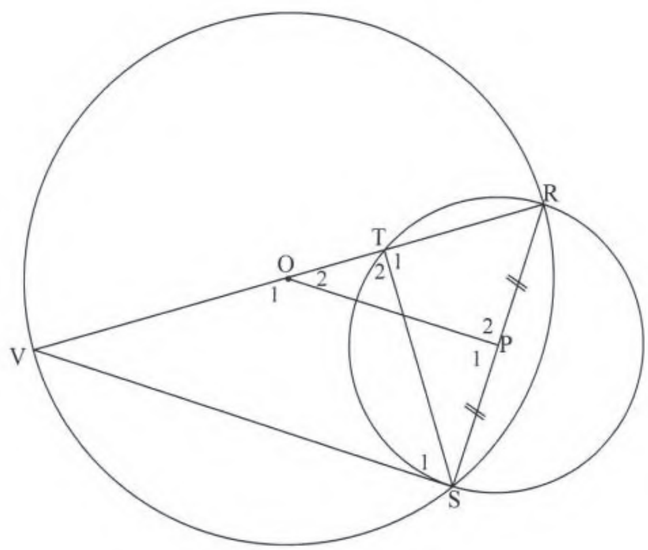
$\hat{A} = \hat{P}, \hat{B} = \hat{Q}$ and $\hat{C} = \hat{R}$.





Prove the theorem that states that if $\Delta ABC \,|||\, \Delta PQR$ then $\frac{AB}{PQ} = \frac{AC}{PR}$. (6)

6.2 Given in the diagram below, VR is the diameter of the circle with centre O. S is a point on the circumference. P is the midpoint of RS. The circle with RS as diameter intersects VR at T. ST, OP and SV are drawn.



6.2.1 Give a reason why $OP \perp RS$. (1)

6.2.2 Prove that $\Delta ROP \,|||\, \Delta RVS$. (4)

6.2.3 Prove that $\Delta RVS \,|||\, \Delta RST$. (3)

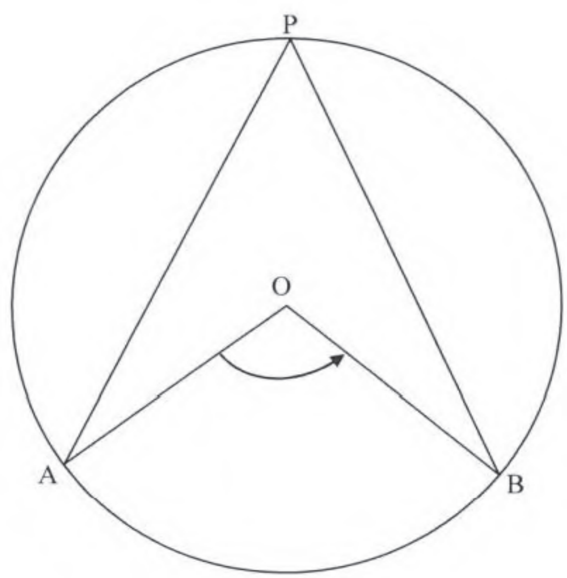
6.2.4 Prove that $ST^2 = VT.\,TR$ (5)

[19]

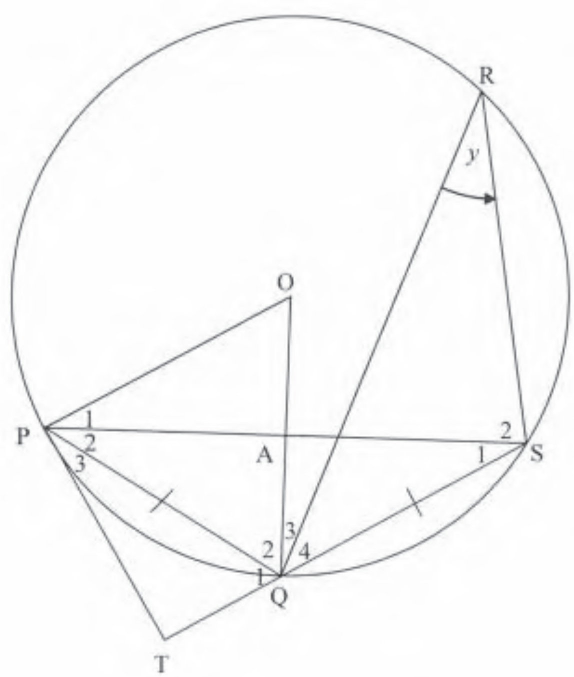
QUESTION 7

7.1 In the diagram below, O is the centre of the circle and P is a point on the circumference of the circle. Arc AB subtends $A\hat{O}B$ at the centre of the circle and $A\hat{P}B$ at the circumference of the circle.

Use the diagram to prove the theorem that states that $A\hat{O}B = 2A\hat{P}B$ (5)



7.2 In the diagram, O is the centre of the circle and P, Q, S and R are points on the circle. PQ = QS and $Q\hat{R}S = y$. The tangent PT at P meets SQ produced at T. OQ intercepts PS at A.



7.2.1 Give a reason why $\hat{P}_2 = y$. (1)

7.2.2 Prove that PQ bisects $T\hat{P}S$. (4)

7.2.3 Determine $P\hat{O}Q$ in terms of y. (2)

7.2.4 Prove that PT is a tangent to the circle that passes through P, O and A. (2)

7.2.5 Prove that $O\hat{A}P = 90°$. (4)

[18]

Total Section A: 73 marks

SECTION B: OPTIONAL

QUESTION 8

8.1 Calculate the following without using calculator:

81.1 $\sin 236°.\cos 169° + \sin 371.\cos(-124°)$ (4)

8.1.2 $\dfrac{-\cos 10° + \sin^2 190°}{\cos(-145°).\cos 235°}$ (6)

8.2 Prove the following identities:

8.2.1 $\dfrac{\cos 2A + \sin A}{\cos^2 A} = \dfrac{2\sin A + 1}{1 + \sin A}$ (5)

8.2.2 $\dfrac{\sin(x + 45°)}{\cos(x - 45°)} = \dfrac{\sin 2x + 1}{(\sin x + \cos x)^2}$ (6)

8.3 Determine the general solution for:

8.3.3 $2\sin(3x - 15°) + 1 = 0$ (4)

8.3.4 Hence determine all possible values for x,

If $x \in [-270°; 90°]$ (2)

[27]

Total Section B: 27 marks

INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$A = P(1+ni)$ $A = P(1-ni)$ $A = P(1-i)^n$ $A = P(1+i)^n$

$T_n = a + (n-1)d$ $S_n = \frac{n}{2}\left(2a + (n-1)d\right)$

$T_n = ar^{n-1}$ $S_n = \frac{a\left(r^n - 1\right)}{r-1}$; $r \neq 1$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x\left[(1+i)^n - 1\right]}{i}$ $P = \frac{x[1-(1+i)^{-n}]}{i}$

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ $M\left(\frac{x_1 + x_2}{2} ; \frac{y_1 + y_2}{2}\right)$

$y = mx + c$ $y - y_1 = m(x - x_1)$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$

In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $a^2 = b^2 + c^2 - 2bc.\cos A$ $area\ \Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta$ $\sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta$ $\cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$ $\sin 2\alpha = 2\sin\alpha.\cos\alpha$

$\bar{x} = \frac{\sum fx}{n}$ $\sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n}$

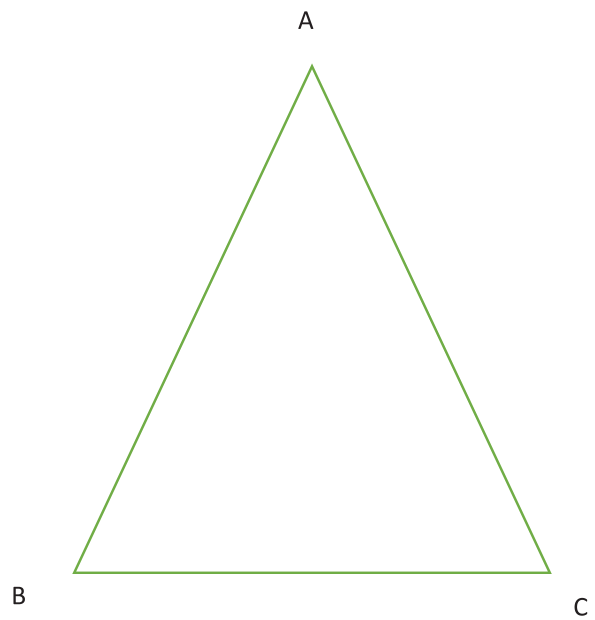
$P(A) = \frac{n(A)}{n(S)}$ $P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$

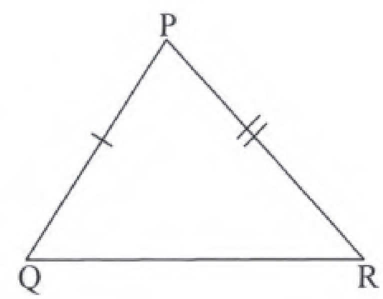
$\hat{y} = a + bx$ $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

Diagram Sheet

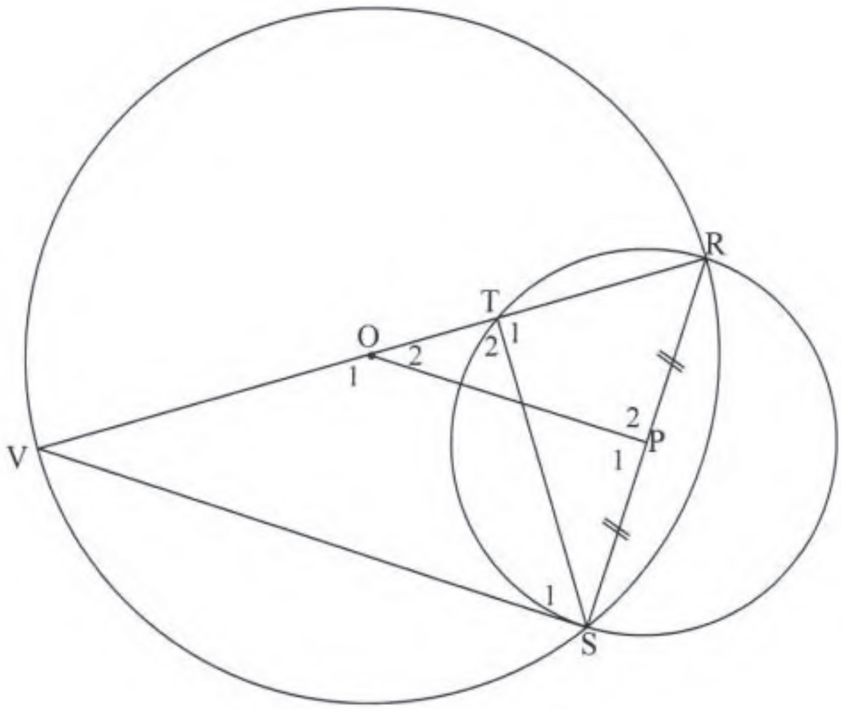
Question 6

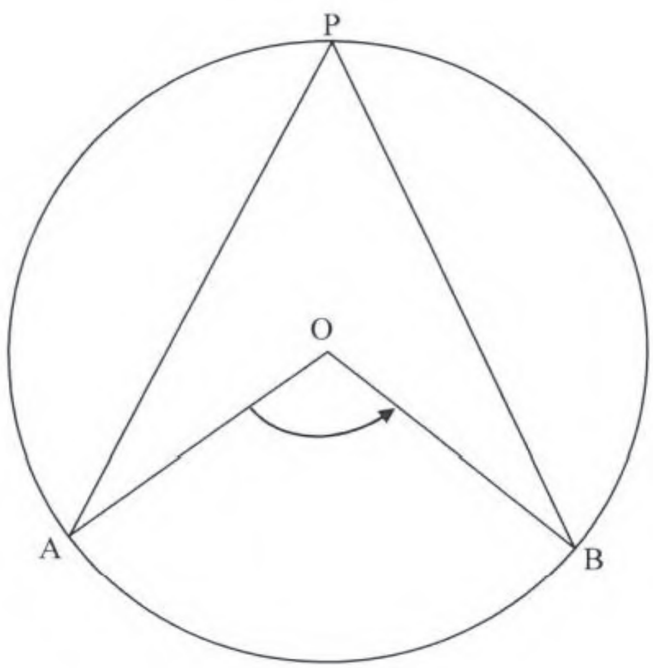
6.1





6.2





7.1

7.2