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MATHEMATICS SPM: MATHEMATICAL REASONING

1. Determine whether each of the following statements is true or false. i. Triangle is a polygon and pentagon has nine sides. ii. Triangle is a polygon or pentagon has nine sides.	2. Determine whether each of the following statements is true or false. i. $\frac{2}{5} \in$ {integers} or $\varnothing \subset$ {s, i, f, a, r} ii. $\frac{2}{5} \in$ {integers} and $\varnothing \subset$ {s, i, f, a, r}	3. State whether each of the following statements is true or false. i. $4 \div \frac{1}{2} = 8$ and $4^{\frac{1}{2}} = -2$ ii. The elements of set P = {11, 17, 23} are prime numbers or the elements of set Q = {4, 16, 55} are perfect squares.	4. State whether each of the following statements is true or false. i. $7^{-2} = -14$ or $\frac{3}{4} = 0.75$ ii. (-4) x (-5) = 20 and -4 < -5	5. State whether each of the following statements is true or false. i. $\frac{2}{3} > \frac{3}{4}$ and $1\frac{1}{3} = \frac{4}{3}$ ii. $\frac{2}{3} > \frac{3}{4}$ or $1\frac{1}{3} = \frac{4}{3}$
6. State whether each of the following sentences is statement or non-statement. i. $5 \div \frac{1}{5} = 1$ ii. 2x + y = 3	7. State whether each of the following sentences is statement or non-statement. i. 3x > 2y ii. 2 – 3 = 5	8. State whether each of the following sentences is statement or non-statement. i. $2\frac{1}{2}$ is a proper fraction and has a value of 2.5 ii. The iron box is a cube.	9. State whether each of the following sentences is statement or non-statement. i. Eight is greater than six ii. Is the digit 5 in 2158 represents the place value tens?	10. State whether each of the following sentences is statement or non-statement. i. Subtract 2 from both sides of the equation. ii. $\frac{19}{22}$ is an improper fraction.
11. Write two implication from the sentence below: a) "Chord JK is a diameter of a circle **if and only if** the chord JK passes through the centre of the circle.	b) "$12k^2 + k - 6 = 0$ **if and only if** $(3k - 2)(4K + 3) = 0$"	c) "$2r - 5 = 4 - r$ **if and only if** $r = 3$"	d) " $(r - 7)^3 = 27$ **if and only if** $r = 10$"	e) "$M^2 = I$ **if and only if** $M^{-1} = M$"

f) $4x + 3 = 7$ **if and only if** $x = 1$	g) "ABC is an equilateral triangle **if and only if** $\angle A = \angle B = \angle C = 60^0$"	h) "{1, x} = {4, 1} **if and only if** x = 4"	i) "679 is a multiple of 7 **if and only if** 679 is divisible by 7"	j) "A number is odd **if and only if** the number can be written in the form 2k + 1, k = 0, 1, 2, 3, ……"

12. Complete each of the following arguments.

Premise 1: Premise 2: Conclusion:	If *a* and *b* are two odd numbers, then *a* + *b* is an even number. a and b are two odd numbers.	All indices of the form a^n can be product of a in n times. 32 is an index of the form 2^5.	If $2x = y$, then $4x^2 + y^2 = 4xy$. $4x^2 + y^2 \neq 4xy$	If the ratio of *u* to *v* is 7 : 3, then the ration of *u* + *v* to *u* – *v* is 5 : 2. The ratio of *u* to *v* is 7 : 3.
Premise 1: Premise 2: Conclusion:	All the points that lie in the first quadrant must have positive x-coordinate and y-coordinate. The point J lies in the first quadrant.	If each of the angles in a triangle is 60^0, then the triangle is an equilateral triangle. Triangle LMN is not an equilateral triangle.	If FJLT is a cyclic quadrilateral, then $\angle JFT + \angle JLT = 180^0$. $\angle JFT + \angle JLT \neq 180^0$	If a number is a factor of 12, then the number is a factor of 48 7 is not a factor of 48
Premise 1: Premise 2: Conclusion:	 TUV is a right-angled triangle TUV has an angle of size 90^0.	If m is a positive integer, then m^2 is a perfect square. m^2 is not a perfect square.	If n > 0. then $\frac{n}{2} > \frac{n}{6}$ $\frac{n}{2} < \frac{n}{6}$	If the perimeter of a rectangle is 28cm, then the length of one diagonal of the rectangle is 10cm. The length of one diagonal of the rectangle PQRS is 10cm.

Premise 1: Premise 2: Conclusion:	 The distance of point J from the x-axis are not the same. The point J does not have the same x-coordinate and y-coordinate.	If the value of $\cos 65^0$ is 0.42, then the value of $1 - 1/2 \cos 65^0$ is 0.79. The value of $\cos 65^0$ is 0.42.	 $F \cap S \neq F$ F is not the subset of S.	If a number has two last digits divisible bye 4, then the number is a multiple of 4 The number 370596 is a multiple of 4
Premise 1: Premise 2: Conclusion:	If $\frac{m}{n}$ is a proper fraction, then m is less then n. 7 is less than 9.	All straight lines which inclined downwards to the right have negative gradients MN has negative gradient.	If f = 7, then 9 x f = 63 9 x f = 63	All the cars with engine of capacity greater than 1500 c.c. can travel at maximum speed of 120 km/j on highways. Waja cars have engine of capacity greater than 1500 c.c.

13. Make a general conclusion by induction for each sequence of numbers according to the given pattern.

a) 2, 6, 10, 14, … $2 = 4(1) - 2$ $6 = 4(2) - 2$ $10 = 4(3) - 2$ $14 = 4(4) - 2$ ……..	b) 9, 16, 23, 30, … $9 = 7(1) + 2$ $16 = 7(2) + 2$ $23 = 7(3) + 2$ $30 = 7(4) + 2$ ……..	c) 4, 7, 12, 19, … $4 = 1^2 + 3$ $7 = 2^2 + 3$ $12 = 3^2 + 3$ $31 = 4^2 + 3$ …….	d) 1, 7, 17, 31, … $1 = 2 \times 1^2 - 1$ $7 = 2 \times 2^2 - 1$ $17 = 2 \times 3^2 - 1$ $31 = 2 \times 4^2 - 1$ ……	e) 6, 21 86, 261, … $6 = 1^4 + 5$ $21 = 2^4 + 5$ $86 = 3^4 + 5$ $261 = 4^4 + 5$ ……
f) The number of terms in the expansion $(x + y)^2$ is 3. The number of terms in the expansion $(x + y)^3$ is 4. The number of terms in the expansion $(x + y)^4$ is 5 ……	g) 1, 22, 57, 106, … $1 = 7(1)^2 - 6$ $22 = 7(2)^2 - 6$ $57 = 7(3)^2 - 6$ $106 = 7(4)^2 - 6$ ……..	h) 0, 7, 26, 63, … $0 = 1^3 - 1$ $7 = 2^3 - 1$ $26 = 3^3 - 1$ $63 = 4^3 - 1$ ……	i) 1, 5, 9, 13, … $1 = 4(1) - 3$ $5 = 4(2) - 3$ $9 = 4(3) - 3$ $13 = 4(4) - 3$ ……	j) 7, 10, 15, 22, … $7 = 1^2 + 6$ $10 = 2^2 + 6$ $15 = 3^2 + 6$ $22 = 4^2 + 6$ ……