GRADE 11

MATHEMATICS

NOVEMBER PAPER 1

2022

EXAMINER: PHOENIX CENTRAL CLUSTER

MODERATOR: PHOENIX CENTRAL CLUSTER

MARKS: 100

DATE: 8 NOVEMBER 2022

TIM: 2 HOURS

INSTRUCTION TO LEARNERS:

1. This question paper consists of 7 pages and 8 questions.

2. Answer ALL questions.

3. Number the questions correctly according to the numbering system used in this question paper.

4. Clearly show ALL calculations, diagrams, graphs et cetera that you have used in determining your answers.

5. Answers only will not necessarily be awarded full marks.

6. You may use an approved scientific calculator (non-programmable and non-graphical), unless otherwise stated.

7. If necessary, round off answers to TWO decimal places, unless otherwise stated.

8. Diagrams are NOT necessarily drawn to scale.

9. Write neatly and legibly.

QUESTION 1

1.1 Solve for x in each of the following;

    1.1.1 $(2x - 1)(x + 2) = 0$ (2)

    1.1.2 $4x^2 - 3x - 5 = 0$ (correct to TWO decimal places.)   (3)

    1.1.3 $x^2 - 8x \leq 0$ (3)

    1.1.4 $\sqrt{14 - x} + 2 = x$ (4)

1.2 Solve for x and y simultaneously:

    $y + 4 = 2x$ and $x^2 - xy + 21 = 0$ (6)

1.3 If the roots of a quadratric equation are given by $\dfrac{-2 \pm \sqrt{4 - 20m}}{2}$, calculate the value/s of m, for which the equation will have real roots.   (3)

                                                                             [21]

QUESTION 2

2.1 Simplify fully, without using a calculator:

$$\frac{5^{2015} + 5^{2013}}{25^{1006}}$$ (3)

2.2 Solve for x without using a calculator:

    2.2.1 $5^{10 - 3x} = 1$ (3)

    2.2.2 $2x^{-\frac{2}{3}} = 50$ (3)

                                                                           [9]

QUESTION 3

3.1 Given the finite linear pattern: 9; 4; -1; …; -311

3.1.1 Determine the formula for the general term of the pattern.   (2)

3.1.2 Calculate the number of terms in the pattern.   (2)

3.2   The first 3 terms of a linear pattern are: $t + 1; 2t - 1; t + 5$

        Show that the terms generated by this pattern are odd.   (3)

                                                                                  [7]

QUESTION 4

Given the quadratic pattern: $-4; 0; 10; 26; \ldots$

4.1   Write down the value of T_5.   (1)

4.2   Show that the general term of the quadratic pattern is given by

        $T_n = 3n^2 - 5n - 2$.   (3)

4.3   Between which 2 consecutive terms in the pattern will the first difference be 520? (3)

4.4   Does this pattern have a minimum or maximum value? Justify the answer.   (2)

                                                                                  [9]

QUESTION 5

Consider the following functions:

$f(x) = 3^{x+1} - 1$ and $g(x) = -2x + 2$

5.1   Write down the equation of the horizontal asymptote of f.   (1)

5.2   Determine the coordinates of the x and y intercepts of f.   (4)

5.3   Sketch the graphs of f and g on the same set of axes.   (5)

        Use the graph paper provided on ANNEXURE A.

5.4   Determine the values of x for which $f(x) - g(x) \leq 0$.   (2)

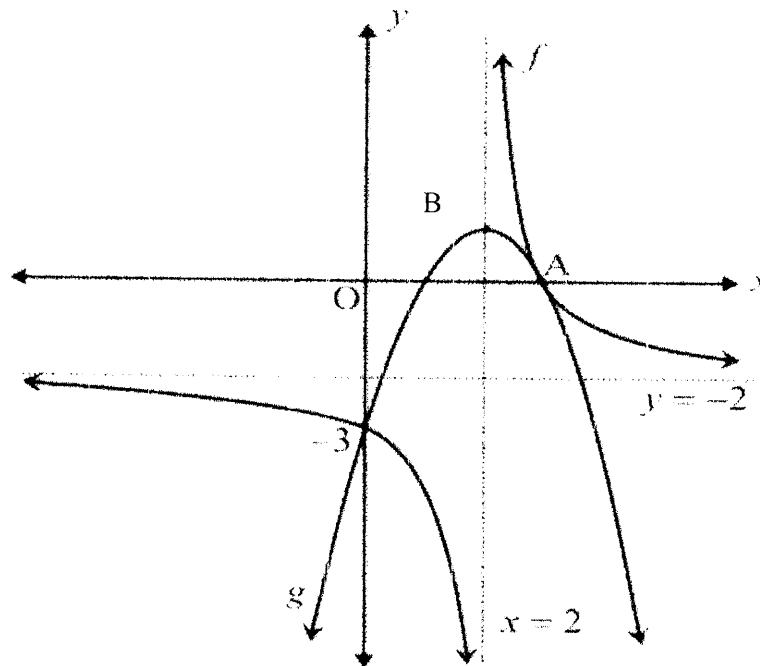5.5   If the graph of f is reflected about the x-axis and shifted 3 units upwards to form

        $h(x)$, determine the range of h.   (3)

                                                                                  [15]

QUESTION 6

In the diagram below, the graphs of $f(x) = \dfrac{a}{x+b} + c$ and $g(x) = -(x-2)^2 + 1$ both cut the y-axis at -3 and the x-axis at A.

f and g intersect at y = -3 and A. B is the turning point of $g(x)$.

6.1	Write down the values of b and c.	(2)
6.2	Hence, determine the equation of f.	(2)
6.3	What is the equation of the axis of symmetry of f that has a positive gradient.	(2)
6.4	Determine the coordinates of B.	(2)
6.5	Calculate the length of OA.	(3)
6.6	Determine the average gradient between B and A.	(2)
6.7	For what value/s of k will $g(x) = k$ have no real roots?	(2)

[15]

QUESTION 7

7.1 A car rental company bought a fleet of 15 cars for R3000 000. They calculate the depreciation at a rate of 15% p.a on a reducing-balance method. Calculate the value of the fleet of cars at the end of 5 years. (2)

7.2 An investment earns 7,5% p.a compounded quarterly. Calculate the effective annual interest rate on this investment. (3)

7.3 Amanda deposits R50 000 into a savings account which pays 11% p.a compounded monthly. She wants to buy a car in 5 years time. Calculate how much money is available to her in 5 years time, if a further payment of R10 000 was made exactly 2 years after her initial deposit. (5)

[10]

QUESTION 8

8.1 Given the following: $P(A) = 0,2$, $P(B) = 0,5$ and $P(A \text{ or } B) = 0,6$

Are the events A and B independent? Show all calculations. (3)

8.2 Study the table below and answer the questions based on it.

	LIKE SPORT	DON'T LIKE SPORT	TOTAL
MALES	80	60	b
FEMALES	a	90	210
TOTAL	200	150	350

8.2.1 Write down the values of **a** and **b**. (2)

8.2.2 Determine the probability of choosing a female that likes sport. (1)

8.3 In a survey a group of 283 workers were asked which mode of transport the use to go to work. The results of the survey are summarised below. These are the only forms of transport used by the workers.

- 27 workers take a train, a bus and a taxi to get to work.
- 110 workers take a train and a taxi.
- 38 workers take a taxi and a bus.
- 32 workers take a train and a bus but not a taxi.
- 60 get to work by taxi only.
- 110 workers take a bus.
- 172 workers take train.

8.3.1 Complete the Venn diagram below to represent this information by calculating the values of a, b, c, and d.
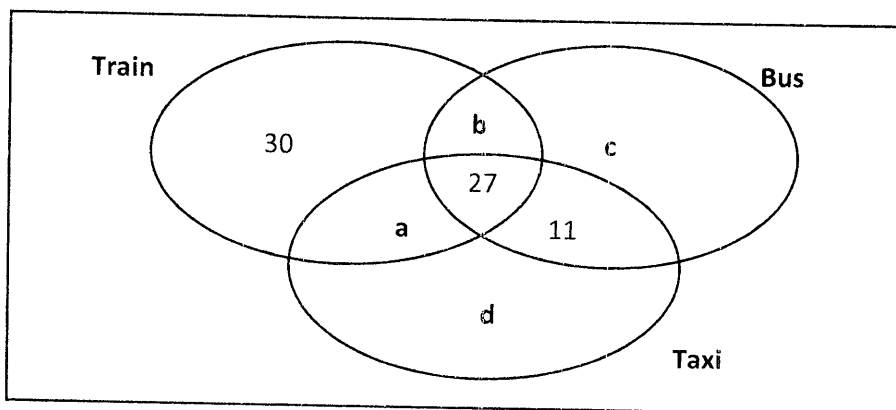
(4)

8.3.2 What is the probability that a worker picked at random takes a taxi to work? (2)

8.3.3 What is the probability that a worker picked at random takes a train and a bus to work? (2)
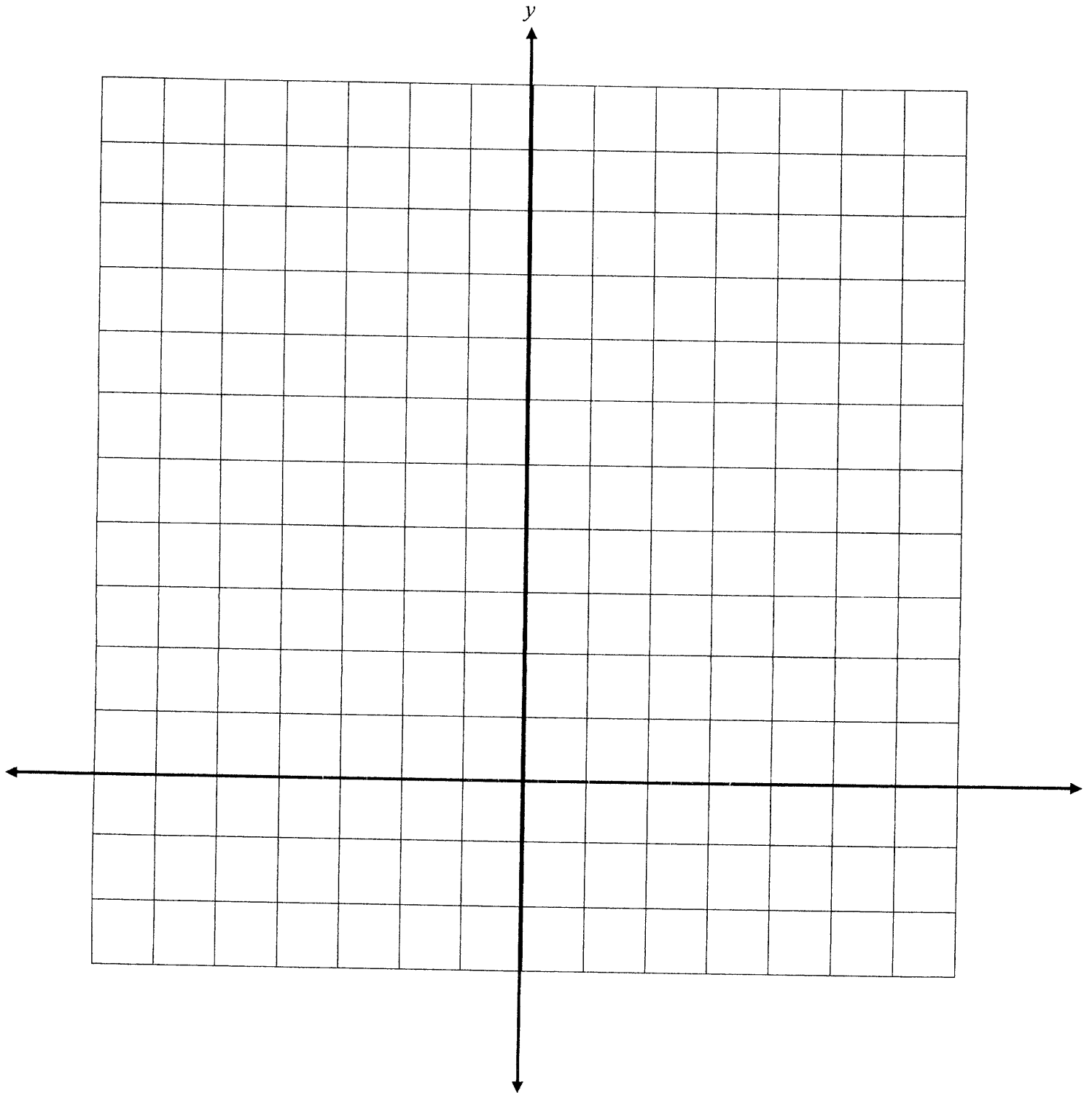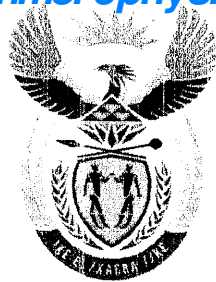
[14]

TOTAL MARKS - 100

ANNEXURE A

QUESTION 5.3

NAME - _____ GRADE – 11_____

GRADE 11

MATHEMATICS

NOVEMBER PAPER 1

2022

MEMORANDUM

MARKS: 100

TIME: 2 HOURS

THIS MEMORANDUM CONSISTS OF 6 PAGES

NOVEMBER EXAMINATION 2022

MATHEMATICS PAPER 1 – GRADE 11

MARKING MEMORANDUM

QUESTION 1				
1.1.1	$(2x - 1)(x + 2) = 0$ $x = \dfrac{1}{2}$ ✓ $or\ x = -2$✓	✓A ✓A	L1	2
1.1.2	$4x^2 - 3x - 5 = 0$ $x = \dfrac{-(-3) \pm \sqrt{(-3)^2 - 4(4)(-5)}}{2(4)}$✓ $x = -0,80$ ✓ $or\ \ x = 1,55$✓	✓A subst. into correct formula ✓CA ✓CA	L2	3
1.1.3	$x^2 - 8x \leq 0$ $x(x - 8) \leq 0$✓ C.V's : 0; 8 $0 \leq x \leq 8$✓✓	✓A factors ✓CA interval notation ✓CA		
1.1.4	$\sqrt{14 - x} + 2 = x$ $(\sqrt{14 - x})^2 = (x - 2)^2$✓ $\quad\ 14 - x = x^2 - 4x + 4$ $x^2 - 3x - 10 = 0$✓ $\quad\quad (x - 5)(x + 2) = 0$ $\quad\ x = 5$ ✓ $or\ \ x = -2\ N/A$✓	✓A isolating surd and squaring ✓CA standard form ✓CA answer ✓CA answer and rejection	L2	4
1.2	$y + 4 = 2x \quad\quad\quad (1)$ $x^2 - xy + 21 = 0 \quad (2)$ $y = 2x - 4 \quad\quad\quad\quad (3)$✓ Subst. (3) in (2) $x^2 - x(2x - 4) + 21 = 0$✓ $\quad x^2 - 2x^2 + 4x + 21 = 0$ $\quad\quad\quad x^2 - 4x - 21 = 0$✓ $\quad\quad\quad (x - 7)(x + 3) = 0$✓ $\quad x = 7 \quad or \quad x = -3$✓ $\quad y = 10 \ or \ y = -10$✓	✓A changing subject of formula ✓CA subst ✓CA standard form ✓CA factors ✓CA x values ✓CA y values Accept alternate answers for x as subject of equation 2	L3	6

1.3	For real roots $\Delta \geq 0$ $\therefore \quad 4 - 20m \geq 0\sqrt{}$ $-20m \geq -4\sqrt{}$ $m \leq \frac{1}{5}\sqrt{}$	$\sqrt{}$A $\sqrt{}$A $\sqrt{}$A		
				21

QUESTION 2

2.1	$$\frac{5^{2015} + 5^{2013}}{25^{1006}}$$ $$= \frac{5^{2012}(5^3 + 5)}{(5^2)^{1006}}\sqrt{}$$ $$= \frac{5^{2012} \cdot 130}{5^{2012}}\sqrt{}$$ $$= 130\sqrt{}$$	$\sqrt{}$A common factor $\sqrt{}$A 5^{2012} in denominator $\sqrt{}$A	L3	3
2.2.1	$$5^{10-3x} = 1$$ $$5^{10-3x} = 5^0 \sqrt{}$$ $$\therefore \quad 10 - 3x = 0\sqrt{}$$ $$-3x = -10$$ $$x = \frac{10}{3}\sqrt{}$$	$\sqrt{}$A for 5^0 $\sqrt{}$A equating powers $\sqrt{}$A	L2	3
2.2.2	$$2x^{-\frac{2}{3}} = 50$$ $$x^{-\frac{2}{3}} = 25\sqrt{}$$ $$x^{-\frac{2}{3} \times -\frac{3}{2}} = 5^2 \sqrt{}$$ $$x = 5^{-3}$$ $$x = \frac{1}{125}\sqrt{}$$	$\sqrt{}$A dividing by 2 $\sqrt{}$A multiplying powers by $-\frac{3}{2}$ $\sqrt{}$A	L2	3
				9

QUESTION 3				
3.1.1	$T_n = -5n + 14$ √√	√A for -5 √A for 14	L2	2
3.1.2	$-5n + 14 = -311$ √ $-5n = -325$ $n = 65$ √	√ CA equating T_n to 311 √CA answer	L2	2
3.2	$2t - 1 - (t + 1) = t + 5 - (2t - 1)$ √ $2t = 8$ $t = 4$ Sequence : 5; 7; 9; … $T_n = 2n + 1$ √ 2n is divisible by 2 therefore it is always even. ∴ 2n + 1 is always odd.	√A equating differences √CA √J	L4	3
				7

QUESTION 4				
4.1	48√	√A	L1	1
4.2	$2a = 6$√ $a = 2$ $3a + b = 4$ $3(3) + b = 4$√ $b = -5$ $a + b + c = -4$ $3 + (-5) + c = -4$√ $c = -2$ $T_n = 3n^2 - 5n - 2$	√A √A √A	L2	3
4.3	$3(n + 1)^2 - 5(n + 1) - 2 - (3n^2 - 5n - 2) = 520$√ $3n^2 + 6n + 6 - 5n - 5 - 2 - 3n^2 + 5n + 2 = 520$ $6n = 522$√ $n = 87$ Between terms 87 and 88.√	√A √A √A	L3	3
4.4	Minimum Value√ $a = 3 > 0$√	√A √A	L4	2
				9

QUESTION 5

5.1	$y = -1$ √	√A	L1	1
5.2	x – int: let y = 0 $3^{x+1} - 1 = 0$ √ $\qquad 3^{x+1} = 1$ $\qquad 3^{x+1} = 3^0$ $\qquad \therefore x = -1$ $\qquad (-1;0)$√ y- int: let x = 0 $\qquad y = 3^{0+1} - 1$ √ $\qquad y = 2$ $\qquad (0;2)$√	√A √A √A √A	L2	4
5.3	Refer to Annexure A	√CA x-int of f √CA y-int of f √CA asymptote y =-1 √ Shape of f √ x and y-int of g	L3	5
5.4	$x < 0 \quad or \ x\epsilon(-\infty; 0)$√√	√√CA for each endpoint	L3	2
5.5	$h(x) = -3^{x+1} + 4$√√ range of h: $y < 4$√	√A for -3^{x+1} √A for 4 √A range	L4	3
				15

QUESTION 6

6.1	b = -2√ c = -2√	√A √A	L1	2
6.2	$\qquad f(x) = \dfrac{a}{x - 2} - 2$ Subst. (0;-3) -3 = $\dfrac{a}{0-2} - 2$√ d = 2 $f(x) = \dfrac{2}{x-2} - 2$√	√A subst. point √A	L2	2
6.3	y = x – 2 - 2 y = x - 4√√	√A for positive x √A for -4	L2	2
6.4	B(2;1)	√A √A	L1	2

6.5	$-(x-2)^2 + 1 = 0\sqrt{}$ $-x^2 + 4x - 4 + 1 = 0$ $x^2 - 4x + 3 = 0$ $(x-3)(x-1) = 0\sqrt{}$ $x = 3 \ or \ x = 1$ $\therefore OA = 3 \ units\sqrt{}$	$\sqrt{}A$ $\sqrt{}A$ $\sqrt{}A$	L3	3
6.6	Average gradient $= \frac{0-1}{3-2} \ \sqrt{} = -1\sqrt{}$	$\sqrt{}CA$ $\sqrt{}CA$	L2	2
6.7	$k > 1\sqrt{}\sqrt{}$	$\sqrt{}A$ inequality $\sqrt{}A$ for 1	L4	2
				15

QUESTION 7				
7.1	$A = P(1 - i)^n$ $A = 3\,000\,000(1 - 0,15)^5\sqrt{}$ $A = R1\,331\,115,94\sqrt{}$	$\sqrt{}A$ subst. into correct formula $\sqrt{}CA$	L2	2
7.2	$1 + i_{eff} = (1 + \frac{i}{n})^n\sqrt{}$ $1 + i_{eff} = (1 + \frac{0,075}{4})^4\sqrt{}$ $i_{eff} = (1 + \frac{0,075}{4})^4 - 1$ $i_{eff} = 7,71\%\sqrt{}$	$\sqrt{}A$ formula $\sqrt{}A$ subst. into formula $\sqrt{}CA$ answer	L2	3
7.3	$A = [R50\,000\left(1 + \frac{0,11}{12}\right)^{24}$ $+ \ R10\,000](1 + \frac{0,11}{12})^{36}$ $A = R100\,334,57$	$\sqrt{}A \ \frac{0,11}{12}$ $\sqrt{} \ n = 24$ $\sqrt{}A$ adding R10 000 $\sqrt{}A \ n = 36$ $\sqrt{}CA$ answer	L3	5
				10

QUESTION 8

8.1	$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ $0,6 = 0,2 + 0,5 - P(A \text{ and } B)\checkmark$ $P(A \text{ and } B) = 0,1$ $P(A) \times P(B) = 0,2 \times 0,5 = 0,1\checkmark$ $P(A \text{ and } B) = P(A) \times P(B) = 0,1$ $\therefore$ events A and B are independent.$\checkmark$	$\checkmark$A subst. into formula $\checkmark$A value of $P(A) \times P(B)$ $\checkmark$J	L3	3
8.2.1	$a = 120\checkmark$ $b = 140\checkmark$	$\checkmark$A $\checkmark$A	L1	2
8.2.2	P(Female and Sport) $= \dfrac{120}{350}\checkmark$ $= \dfrac{12}{35}\checkmark$	$\checkmark$CA $\checkmark$CA	L2	1
8.3.1	$a = 83$ $b = 32$ $c = 40$ $d = 60$	$\checkmark$A $\checkmark$A $\checkmark$A $\checkmark$A All values correct	L2	4
8.3.2	$P(\text{taxi}) = \dfrac{172}{283}$	$\checkmark$CA numerator $\checkmark$CA denominator	L2	2
8.3.3	$P(\text{train and bus}) = \dfrac{32+27}{283}\checkmark$ $= \dfrac{51}{283}\checkmark$	$\checkmark$CA $\checkmark$CA	L2	2
				14

TOTAL MARKS - 100

ANNEXURE A

QUESTION 5.3

NAME - _____ GRADE – 11_____