

Name and Surname : .....

Grade/Class : 12/..... Mathematics Teacher : .....

Hudson Park High School



GRADE 11  
MATHEMATICS  
November Paper 1

Marks :

150
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Time : 3 hours

Date : November 2020

Examiner : SLT

Moderator(s) : FRD PHL

## INSTRUCTIONS

1. Illegible work, in the opinion of the marker, will earn zero marks.
2. Number your answers clearly and accurately, exactly as they appear on the Question Paper.
3. **NB**
  - Leave ***2 lines*** open between each of your answers.
  - Start each **new Question** at the top of a **new page**.
4. **NB**
  - Detach the Answer Sheet for Question 4 and fill in the requested details on it.
  - Fill in the details requested on the front of this Question Paper.
  - Hand in your submission in the following manner :
    - Question Paper (on top)
    - Answers on lined paper, with the Answer Sheet for Question 4 in the correct place (after Question 3 and before Question 5), stapled.
  - ***Do NOT staple your Question Paper and Answers together.***
5. Employ relevant formulae and show all working out. Answers alone may not be awarded full marks.
6. (Non-programmable and non-graphical) Calculators may be used, unless their usage is specifically prohibited.
7. Round off answers to 2 decimal places, where necessary, unless instructed otherwise.
8. If (Euclidean) Geometric statements are made, reasons must be stated appropriately.

## QUESTION 1

1.1. Solve for  $x$  :

1.1.1.  $7x^2 - x = 0$  (2)

1.1.2.  $12x^2 - 8x - 13 = 0$  (correct to TWO decimal places) (3)

1.1.3.  $16 - \sqrt{x - 4} = x$  (4)

1.1.4.  $x(17 - 6x) \leq -14$  (4)

1.1.5.  $x(x + 2)(3 - x) < 0$  (2)

1.1.6.  $5 \cdot x^{\frac{3}{5}} + 18 = 0$  (3)

1.1.7.  $3^{x+1} - 2 = 5 \cdot 3^{-x}$  (6)

1.2. Solve for  $x$  and  $y$  :

$$x^2 - 5xy - y^2 = 100 \quad \text{and} \quad 3y - x - 22 = 0 \quad (6)$$

1.3. Given :  $(x - 2)(x + 1) = x(3 - k) + k$  where  $k \in \mathbb{R}$ .

1.3.1. For the given equation, determine the discriminant ( $\Delta$ ), showing that :  $\Delta = k^2 - 4k + 24$  (2)

1.3.2. Now, write  $\Delta$  in the form  $a(x - p)^2 + q$ , by completing the square. (2)

1.3.3. Hence, discuss the nature of the roots of the original (given) equation. Justify your answer appropriately. (2)

**[36]**

## QUESTION 2

**CALCULATORS MAY NOT BE USED IN THIS QUESTION**

2.1. Simplify fully :

2.1.1.  $\sqrt{48} - 5\sqrt{27}$  (3)

2.1.2.  $x^{\frac{2}{5}} \left( 3x^{-\frac{2}{5}} - 4x^{\frac{5}{2}} \right)$  (2)

2.2. Factorise fully :  $2^{2x} - 3 \cdot 4^{x-1}$  (3)

2.3. Given :  $\frac{\sqrt{\sqrt{21} - \sqrt{5}} \times \sqrt{\sqrt{21} + \sqrt{5}}}{\sqrt{7}} = a\sqrt{b}$  where  $a \in \mathbb{Q}$  and  $b \in \mathbb{N}$ .

Determine, and clearly state, the values of  $a$  and  $b$ . (5)

**[13]**

### QUESTION 3

3.1. Given :  $4; -3; -16; -35; \dots$

For this sequence :

3.1.1. Write down the next term. ( 1)

3.1.2. Determine an expression for the general term,  $T_n$ . ( 4)

3.1.3. If the last term in the sequence is  $-18\ 091$ , how many terms will there be in the sequence ? ( 4)

3.2. Given :  $8x - \pi; 6x - \pi; 4x - \pi; \dots$

For this sequence, in terms of  $x$  and/or  $\pi$ , determine :

3.2.1. The constant difference. ( 1)

3.2.2. An expression for the general term,  $T_n$ .  
Multiply out and simplify your answer. ( 2)

3.3. For a certain sequence, the general term is  $T_n = n^2 - 10n + 4$ .  
In which positions in the sequence will you find two consecutive terms whose sum is  $9\ 619$  ? ( 5)

3.4. The general term of a certain sequence is given by  $T_n = n^2 - 46n + 520$ .

3.4.1. At which position in the sequence will you find the smallest term ? ( 2)

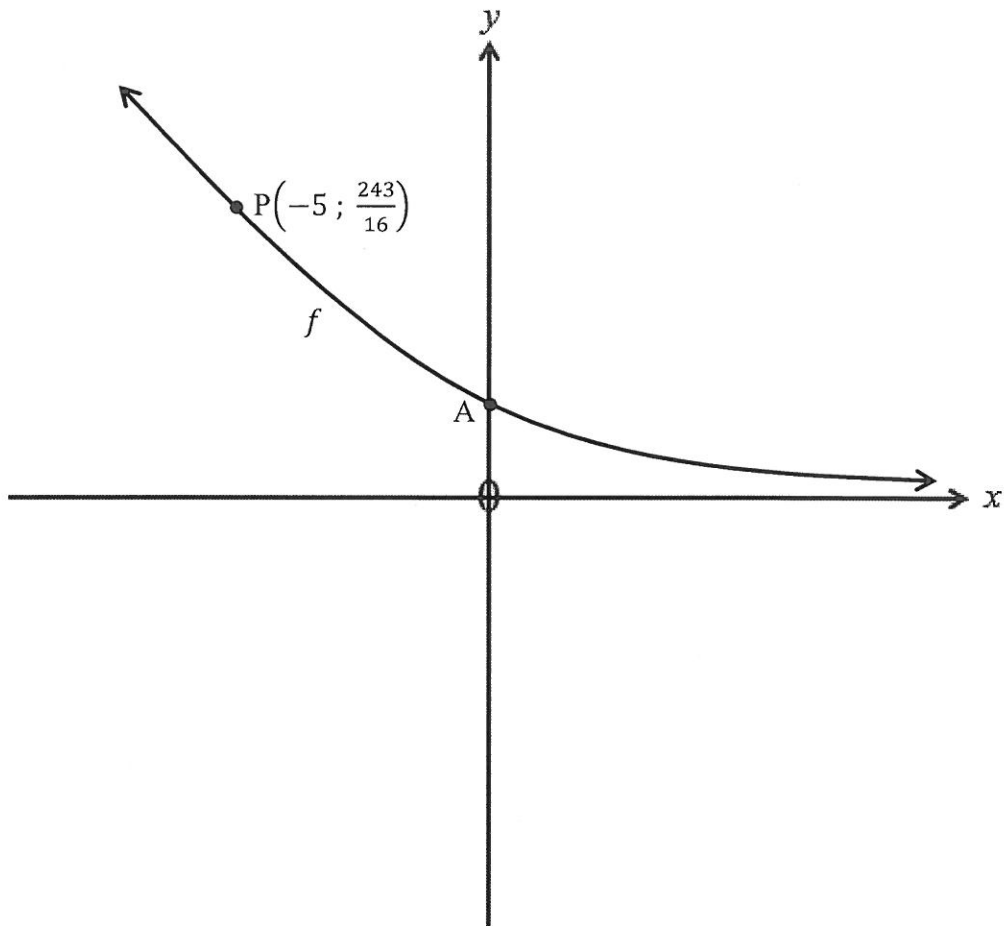
3.4.2. Calculate the product of all of the negative terms in the sequence. ( 3)

**[22]**

## QUESTION 4

### USE THE ANSWER SHEET PROVIDED

4. Sketched below is the graph of  $f(x) = 2 \cdot b^x$  with  $P\left(-5; \frac{243}{16}\right)$ :

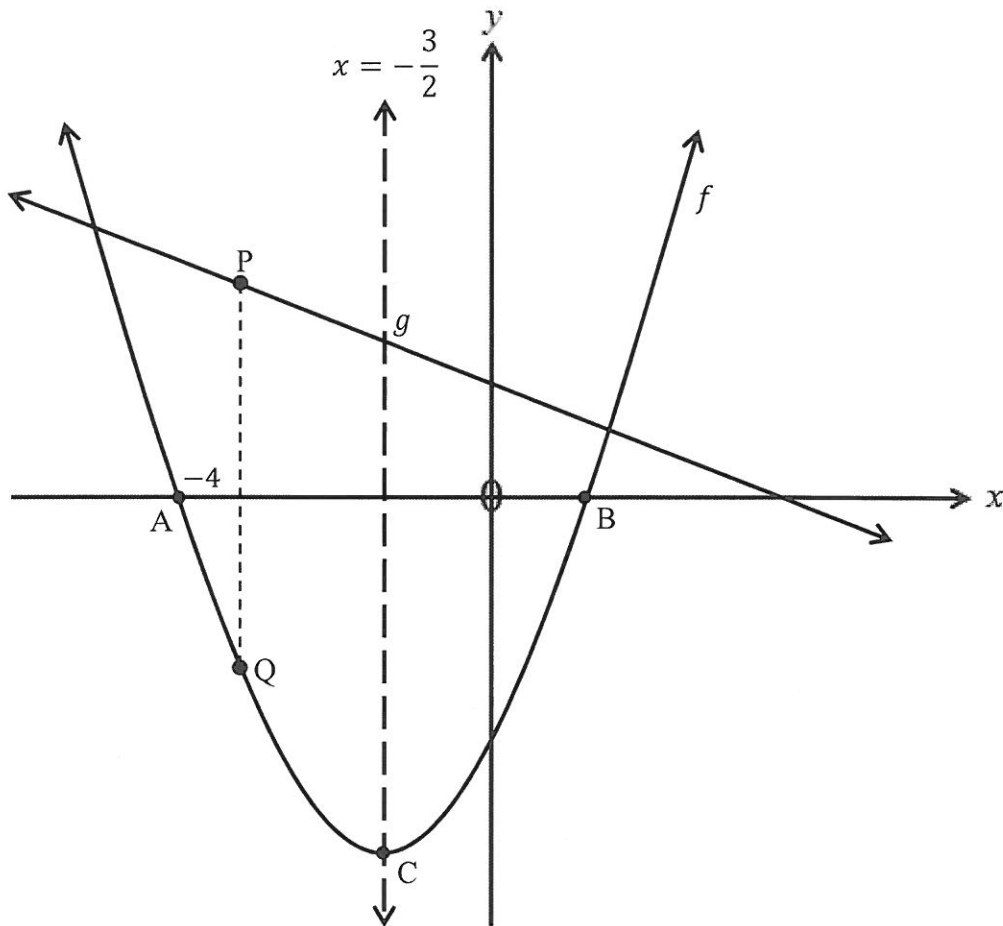


- 4.1. Determine the coordinates of A. (1)
- 4.2. Write down the equation of the horizontal asymptote of  $f$ . (1)
- 4.3. On the given set of axes, sketch the graph of  $g$ , where  $g$  is the reflection of  $f$  in the line  $y = x$ . (2)
- 4.4. Calculate the value of  $b$ , showing all steps and working out. (3)
- 4.5. If  $f$  is translated
- 5 units vertically downwards, and
  - 4 units horizontally to the right
- to become  $h$ , write down the equation of  $h$ , in  $y$ -form.  
You may leave your answer in terms of  $b$  or the value of  $b$  found in (4.4). (2)

[ 9 ]

### QUESTION 5

5. The graphs of  $f(x) = ax^2 + 6x + c$  is and  $g(x) = -2x + 4$  are shown below. PQ is a vertical line, C is the turning point of  $f$ ,  $A(-4; 0)$  and the equation of the axis of symmetry of  $f$  is  $x = -\frac{3}{2}$ .

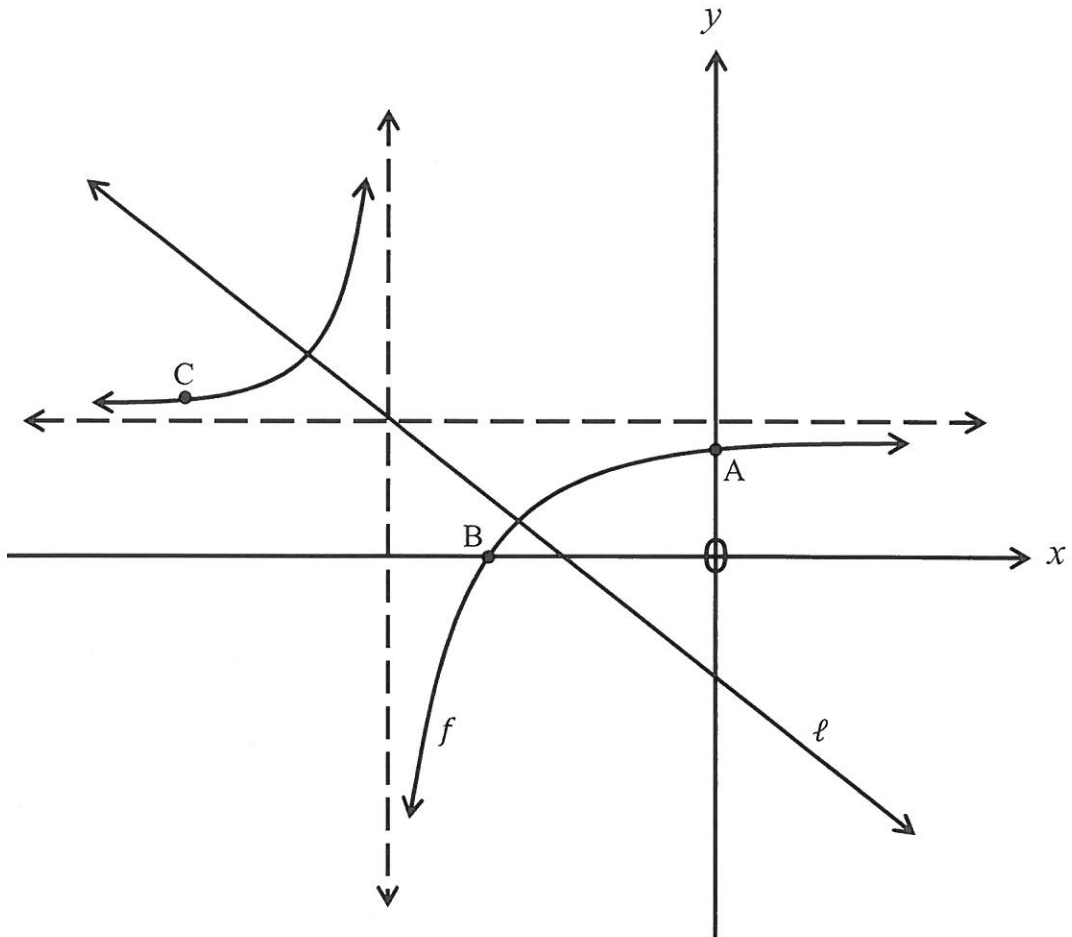


- 5.1. Determine the  $x$ -value of  $B$ , clearly showing that it will be equal to 1. (1)
- 5.2. Calculate the values of  $a$  and  $c$ , showing that they will be 2 and  $-8$ , respectively. (3)
- 5.3. Write down the values of  $x$  for which  $f$  will be decreasing. (1)
- 5.4. State the range of  $f$ . (2)
- 5.5. Calculate the maximum length of  $PQ$ . (4)
- 5.6. If  $h$  is the reflection of  $f$  in the  $x$ -axis, determine the equation of  $h$ , in  $y$ -form. (1)
- 5.7. Calculate the average gradient of  $f$  between  $x = -2$  and  $x = 3$  (3)

[15]

**QUESTION 6**

6. Shown below are the graphs of  $f(x) = \frac{2x + 5}{x + 4}$  and  $\ell$ , an axis of symmetry of  $f$ . A and B are the  $y$ - and  $x$ -intercepts of  $f$ , respectively, and  $C(-10 ; 2,5)$ .



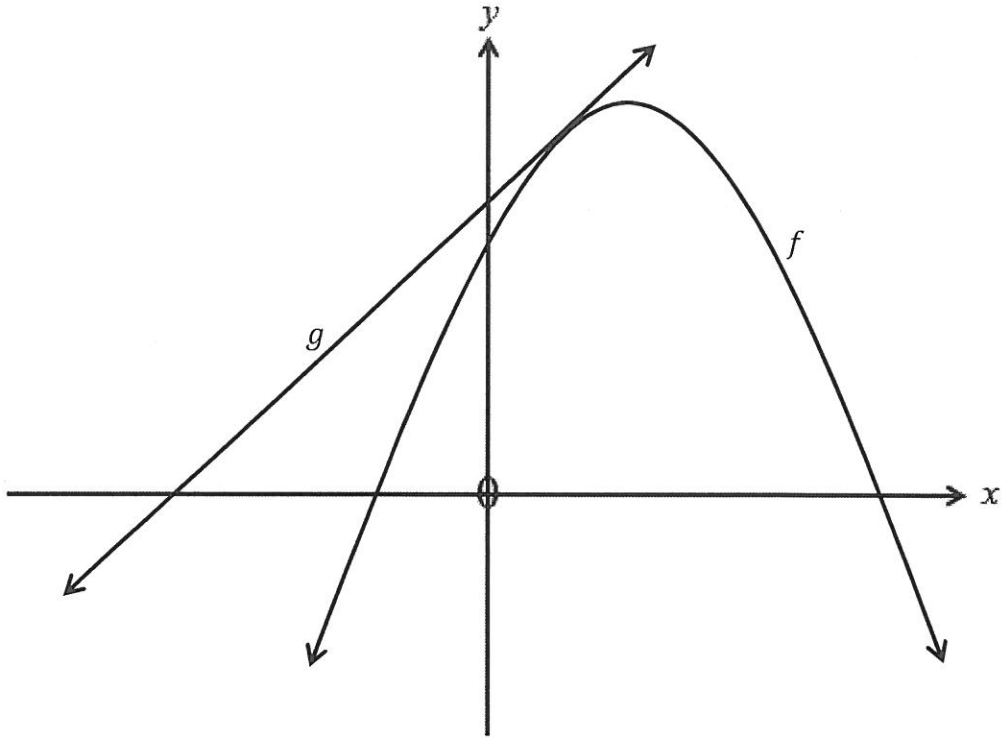
- 6.1. Show that  $f$  can be written as :  $f(x) = -\frac{3}{x+4} + 2$  (2)
- 6.2. Calculate the coordinates of
- 6.2.1. A (1)
- 6.2.2. B (1)
- 6.3. Determine the equation of  $\ell$ . (2)
- 6.4. Solve for  $x$  :  $x \cdot f(x) \leq 0$  (3)
- 6.5. Determine the equation of  $h$ , in  $y$ -form, if  $h$  is the reflection of  $f$  in the line  $y = 2$ . (1)
- 6.6. If  $C$  is reflected in the line  $\ell$  to become  $C'$ , determine the coordinates of  $C'$ . (2)

[12]



## QUESTION 7

7. Shown below are  $f(x) = -2x^2 + 5x + 7$  and  $g(x) = x + c$  :



- 7.1. If  $g$  is a tangent to  $f$ , calculate the value of  $c$ , showing that it will be 9. (5)

- 7.2. Determine the value(s) of  $k$  for which

$$f(x) = g(x) - 2k + 3$$

will have two unequal positive roots. (3)

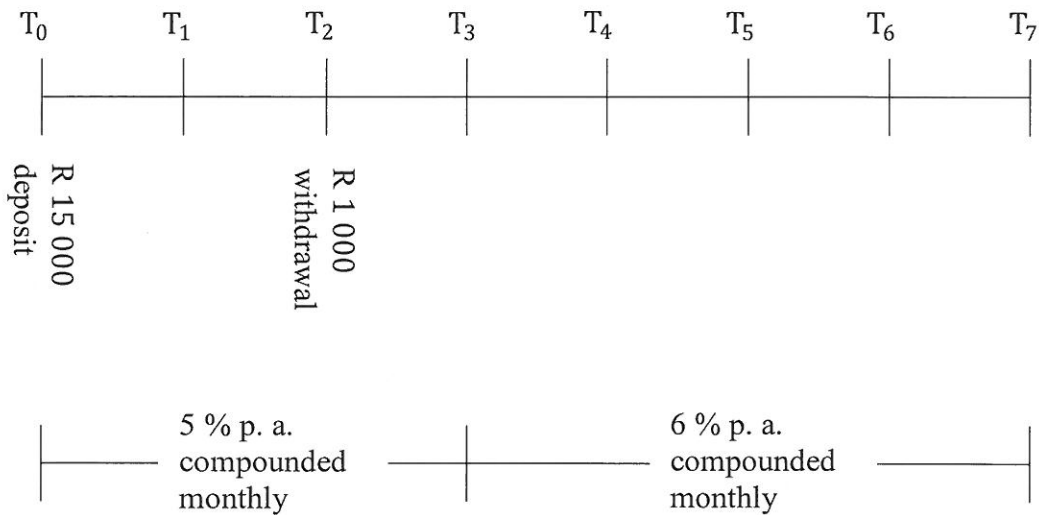
[ 8 ]

**QUESTION 8**

8.1. In 15 years, a vehicle's value depreciated, according to the diminishing balance method, to a quarter of its original (book) value.  
Calculate the rate of depreciation, as a % per annum. (4)

8.2. If 11,2 % per annum compounded semi-annually is equivalent to  $x$  % per annum compounded quarterly, calculate the value of  $x$ . (5)

8.3. On the 1<sup>st</sup> January 2020, R 15 000 is deposited into a new savings account that earns interest of 5 % per annum compounded monthly.  
On the 31<sup>st</sup> December 2021, R 1 000 is withdrawn from the account.  
One year later, the interest rate changes to 6 % per annum compounded monthly.  
What will be the balance in the savings account on 31<sup>st</sup> December 2026 ?

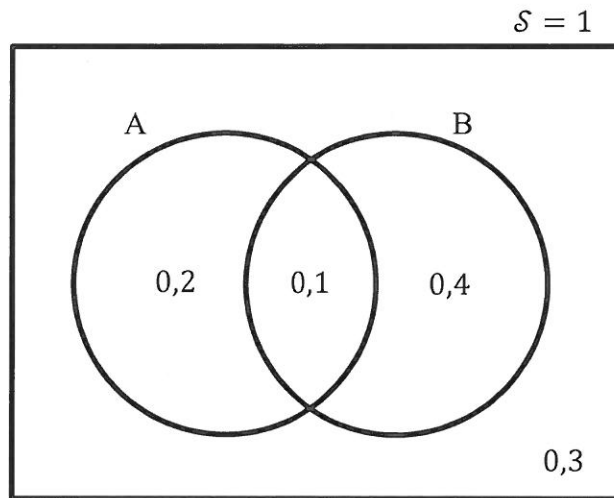


(5)

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## QUESTION 9

9.1. A probability Venn Diagram, for events A and B, is shown below :



Are events A and B :

9.1.1. Mutually exclusive ? Justify your answer. ( 2)

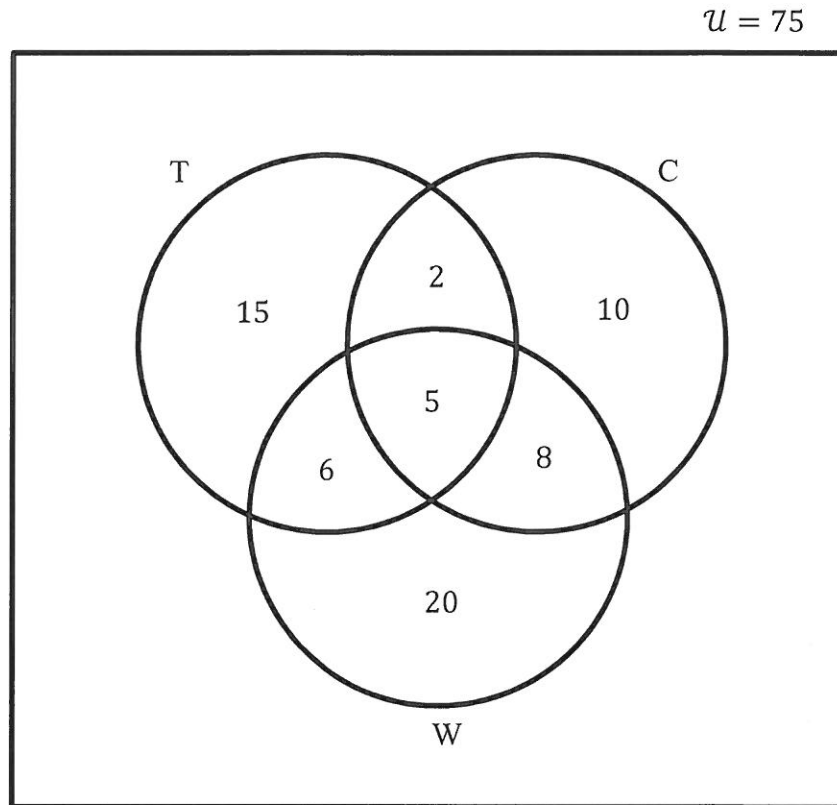
9.1.2. Independent ? Justify your answer. ( 4)

9.2. A bag contains 3 red marbles and 5 green marbles. A marble is drawn from the bag, but not returned to the bag. A second marble is then drawn from the bag.

9.2.1. Represent the scenario above using a fully labeled tree diagram. ( 4)

9.2.2. What is the probability of drawing two marbles that are different colours ? ( 3)

- 9.3. 75 learners were surveyed about their summer sports involvement in Tennis, Cricket and Water-polo :



9.3.1. How many learners :

- |  |       |
|--|-------|
| (a) Were not involved in tennis, cricket or water-polo ? | ( 1 ) |
| (b) Play only one sport ?                                | ( 1 ) |
| (c) Play tennis and water-polo, but not cricket ?        | ( 1 ) |
| (d) Play at least two sports ?                           | ( 1 ) |

9.3.2. Calculate the following probabilities :

- |                            |       |
|----------------------------|-------|
| (a) $P(T \cap C')$         | ( 2 ) |
| (b) $P(T \cup (W \cap C))$ | ( 2 ) |

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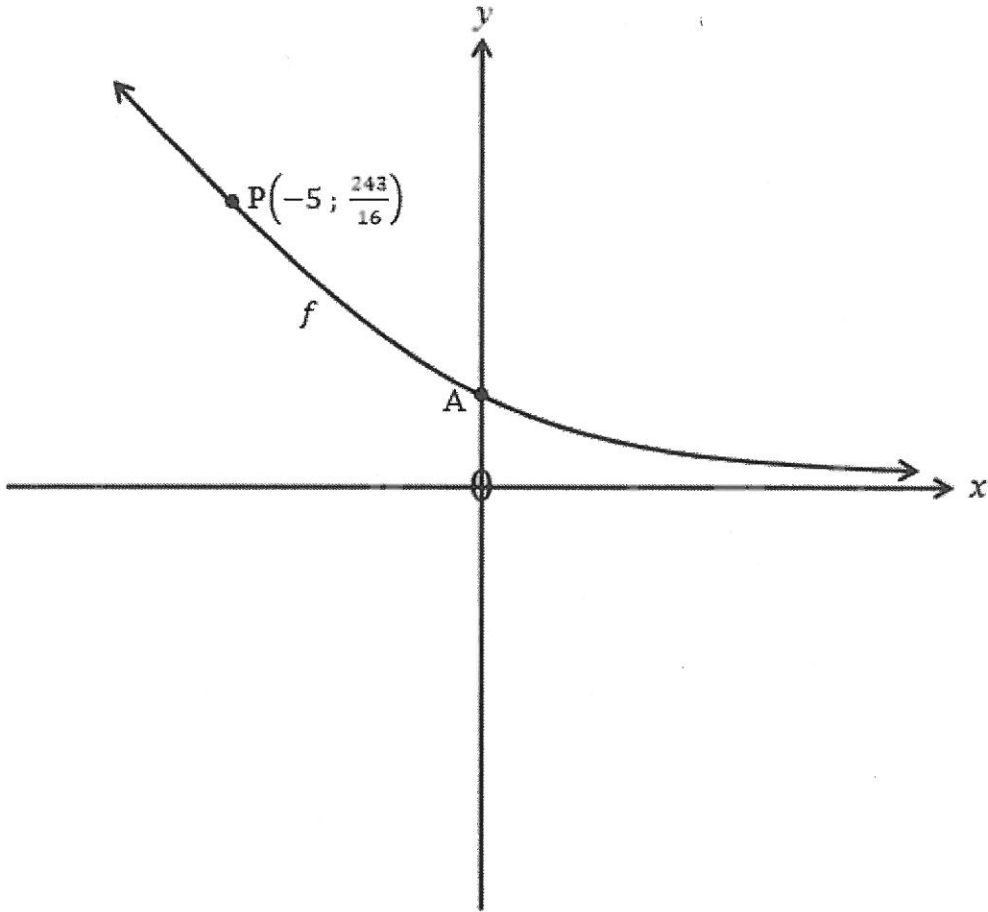
<b>TOTAL 150</b>
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Name and Surname : .....

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**ANSWER SHEET FOR QUESTION 4**

4.



4.1.		
4.2.		

