



Presbyterian Ladies' College

MELBOURNE

VCE
Year 11
2016 Semester 1
Mathematical Methods Unit 1 Examination

PAPER 2

Teacher: Bell, Lewis, Smith, I Taylor, J Taylor (Please circle)

Full Name: _____ **Form:** _____

WRITING TIME: (80 minutes)

Section	Number of Questions	Number of Questions to be answered	Number of Marks
B	15	15	15
C	4	4	57

No. of Pages: 15

Instructions

1. Calculators can be used in both sections of this paper.
2. You are permitted to refer to 8 sides of notes, whilst completing this paper.
3. Whiteout is not permitted.

SECTION B: Multiple Choice: Use the answer sheet provided.

SECTION C: Analysis: Answer the questions in the spaces provided.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Inside Front Cover

1. The maximal domain of the function f with rule $f(x) = \sqrt{5x-7}$ is:
- A $(0, \infty)$
 - B $(-\frac{7}{5}, \infty)$
 - C $(-7, \infty)$
 - D $[-3, \infty)$
 - E $[\frac{7}{5}, \infty)$
2. The discriminant of $x^2 + x - 10$ is:
- A 42
 - B -39
 - C 41
 - D 65
 - E 60
3. When $2x^3 - x^2$ is divided by $2x - 1$ the remainder is:
- A -2
 - B 2
 - C $\frac{1}{2}$
 - D $-\frac{1}{2}$
 - E 0
4. If P has coordinates $(a, \frac{a}{2})$ and Q has coordinates $(-a, \frac{a}{3})$, the coordinates of the midpoint of PQ are:
- A $(a, \frac{a}{5})$
 - B $(0, \frac{5a}{12})$
 - C $(0, \frac{a}{12})$
 - D $(0, \frac{a}{2})$
 - E $(a, \frac{5a}{12})$

5. For $f: (a, b] \rightarrow \mathbb{R}, f(x) = 5 - x$, where $a < b$, the range is:

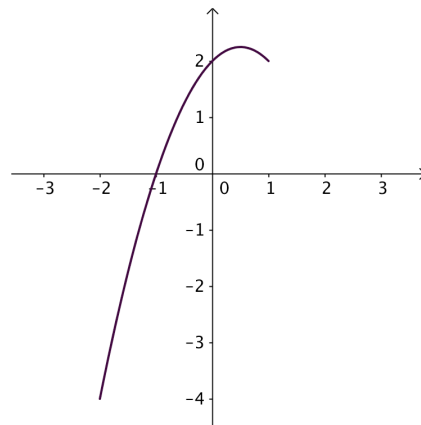
- A $(5 - a, 5 - b)$
- B $(5 - a, 5 - b]$
- C $(5 - b, 5 - a)$
- D $(5 - b, 5 - a]$
- E $[5 - b, 5 - a)$

6. If events X and Y are independent then:

- A $\Pr(X | Y) = \Pr(X \cup Y) - \Pr(X) - \Pr(Y)$
- B $\Pr(X | Y) = \frac{\Pr(X)}{\Pr(Y)}$
- C $\Pr(X | Y) = \Pr(X) + \Pr(Y) - \Pr(X \cap Y)$
- D $\Pr(X | Y) = \Pr(Y)$
- E $\Pr(X | Y) = \Pr(X)$

7. Is the graph to the right representing:

- A one to one function
- B many to one function
- C relation not a function
- D function not relation
- E none of the above



8. For two events A and B , $\Pr(B') = 0.4$, $\Pr(A) = 0.3$ and $\Pr(A \cup B) = 0.1$, then $\Pr(A \cap B)$ is equal to:

- A 0.12
- B 0.18
- C 0.9
- D 0.8
- E 0

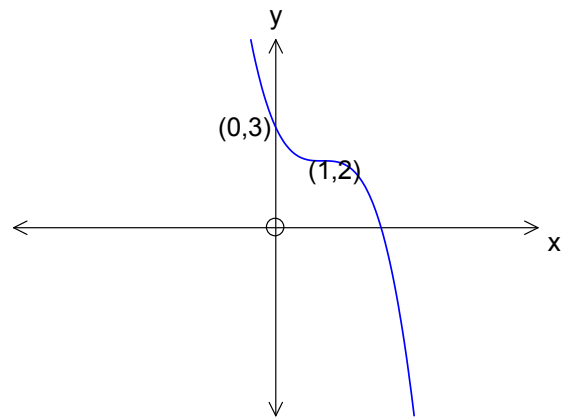
9. If $5x^2 - t = 4x$, and x and t are both positive real numbers, then x is equal to:
- A t
- B $\frac{2}{5} + \frac{\sqrt{4+5t}}{5}$
- C $-\frac{1}{5}$ or 1
- D 1
- E $\frac{2}{5} \pm \frac{\sqrt{4+5t}}{5}$
10. The function $f(x) = x^2$ is dilated by a factor $\frac{1}{2}$ from the y -axis, translated 2 units in the positive direction of the x -axis and translated one unit in the negative direction of the y -axis. The equation of the transformed function is:
- A $y = \frac{1}{2}(x-2)^2 - 1$
- B $y = \frac{1}{2}(x+2)^2 - 1$
- C $y = 4(x+2)^2 - 1$
- D $y = 4(x-2)^2 - 1$
- E $y = 2(x-2)^2 - 1$
11. The line with equation $y = ax + b$ is perpendicular to the line with equation $y = 1 - \frac{x}{3}$. The value of a is:
- A -3
- B $\frac{1}{3}$
- C 3
- D $-\frac{1}{3}$
- E $-\frac{1}{4}$
12. The equation of the parabola that passes through the point $(0, 13)$ and has its vertex at $(3, -5)$ is:
- A $y = -2(x-3)^2 - 5$
- B $y = (x+3)^2 - 5$
- C $y = (x-3)^2 - 5$
- D $y = -(x-3)^2 - 5$
- E $y = 2x^2 - 12x + 13$

13. If for two events A and B , $\Pr(A) = \frac{1}{6}$ and $\Pr(B) = \frac{1}{3}$, and A and B are mutually exclusive, then $\Pr(A \cup B)$ is equal to:

A 0
B $\frac{1}{3}$
C $\frac{1}{2}$
D $\frac{1}{18}$
E $\frac{2}{9}$

14. A possible rule of the graph shown is:

A $y = 2(1-x)^3 + 2$
B $y = (1-x)^3 + 2$
C $y = (x-1)^3 + 2$
D $y = (1-x)^3 - 1$
E $y = 2(x-1)^3 + 2$



15. A **biased** die when tossed has six outcomes where $\Pr(1) = \Pr(2) = \Pr(3) = 0.1$, $\Pr(4) = \Pr(5) = 0.2$ and $\Pr(6) = 0.3$. If the die is tossed twice, find the probability that both numbers are the same.

A 0.02
B 0.2
C 0.002
D $\frac{1}{6}$
E $\frac{3}{5}$

End of Section B

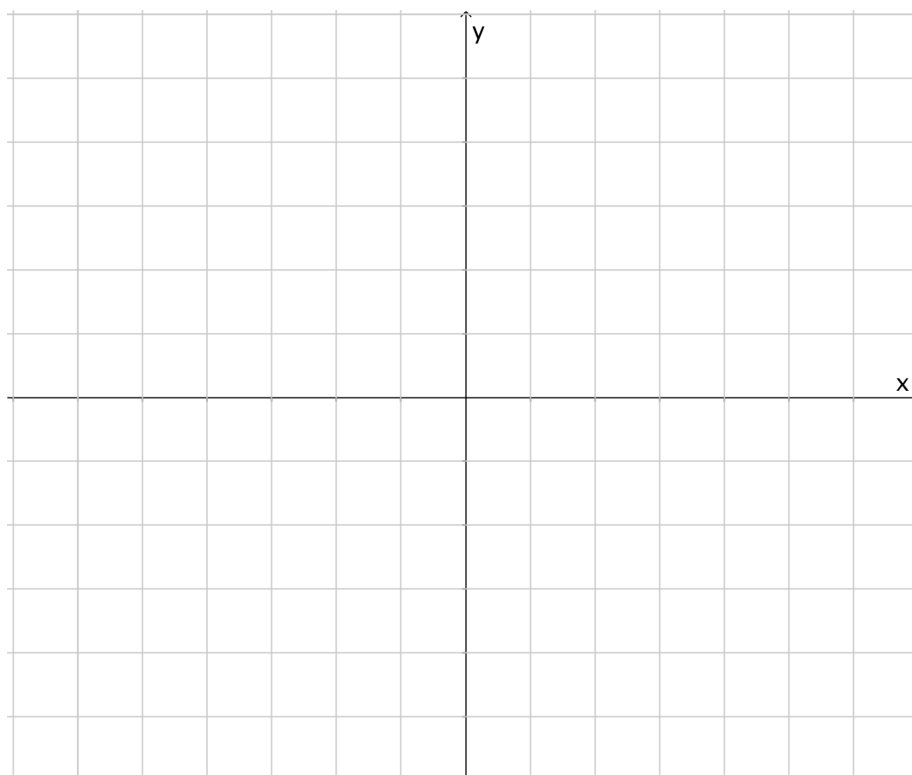
SECTION C: Analysis

Calculators and notes allowed. Exact answers should be given unless instructed otherwise.

Question 1 (17 marks)

A triangle ABC has vertices with coordinates $A(1, 3)$, $B(-3, 1)$ and $C(5, -2)$.

- a** Construct the triangle ABC on the axes below clearly labelling coordinates of the vertices.



(2 marks)

- b** Find the equation of the line connecting the vertices A and C .

(3 marks)

- c** Using the midpoint formula, find the midpoint M of the line AC .

(2 marks)

- d** Find the equation of the line perpendicular to AC which goes through the midpoint M .

(3 marks)

- e** Find the coordinates of the y -intercept for the line found in **d** and sketch this line on the axes in part **a**.

(2 marks)

- f** Find the exact coordinates of the point of intersection of the line sketched in part **d** and the line BC .

(3 marks)

- g** Using the distance formula to find the length of the side AB (answer to two decimal places).

(2 marks)

Work Space Page

**Examination Continues Next Page
PTO**

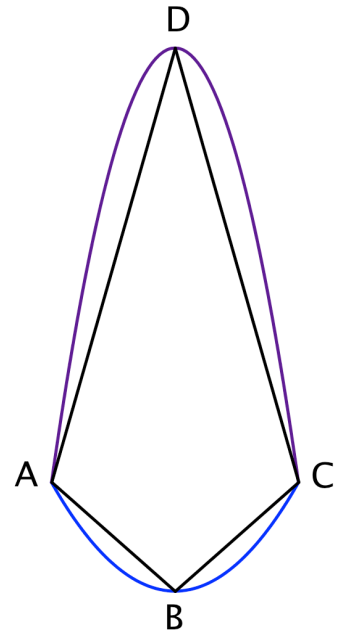
Question 2 (15 marks)

4. An organisation ran a competition for a new logo. Lara entered the logo shown in this competition. She used a set of coordinate axes to plan her design.

The curve ABC is a parabola with equation $y = \frac{3}{4}x^2 - 6x + 12$.

B is the **turning point** of the curve.

- a Show, by completing a square or otherwise, that the coordinates of B are (4, 0)



(2 marks)

The curve ADC is a parabola with equation $y = -3(x - b)^2 + c$.

- b The turning point is when $x = 4$. State the value of b .

(1 mark)

- c Points A and C are (2, 3) and (6, 3) respectively. Find the value of c for the parabola.

(2 marks)

- d Hence state the coordinates of D.

(1 mark)

- e Write the appropriate domain Lara needed for each of the curves in order to draw her logo design.

(2 marks)

The points A, B, C and D are joined with straight lines as shown in the diagram.

f Find the angle between AB and BC. Give the answer correct to the nearest degree.

(4 marks)

g The quadrilateral ABCD is to be made of yellow plastic. What area of plastic is needed?

(2 marks)

h Give the most precise mathematical name for the quadrilateral ABCD.

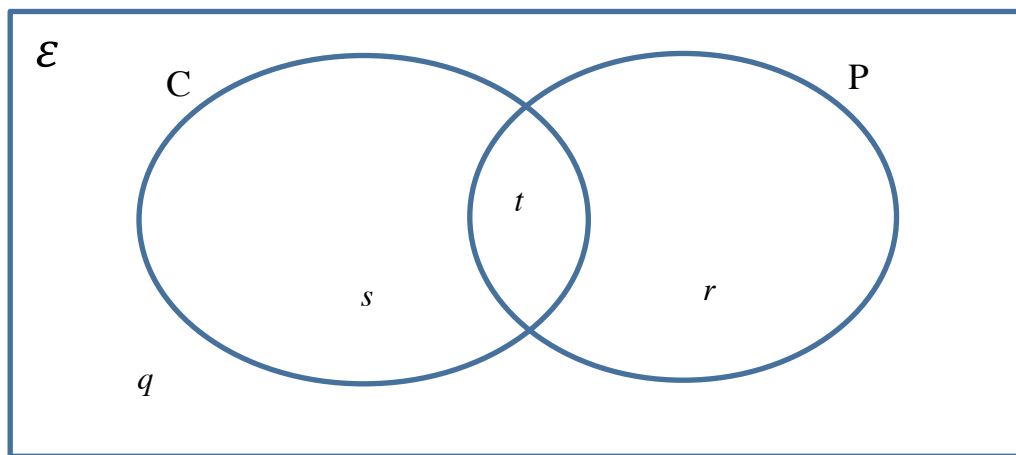
(1 mark)

Question 3 (14 marks)

- a** A drawer contains 8 red socks and 4 blue socks. A sock is drawn without looking and then another one is drawn without looking. Find the probability that a matching pair is drawn.

(3 marks)

- b** In a group of 115 VCE students, 51 study Chemistry, 73 study Physics and 19 study neither. Use this information to find s , t , r and q in the following Venn diagram.



(4 marks)

- c** If a fair die is rolled twice
- i** find the probability that the first roll is an even number, and the second roll is odd.

(1 mark)

- ii** find the probability that one roll is a two, and the other roll is not a two

(2 marks)

- iii** find the probability that the sum of the rolls is nine.

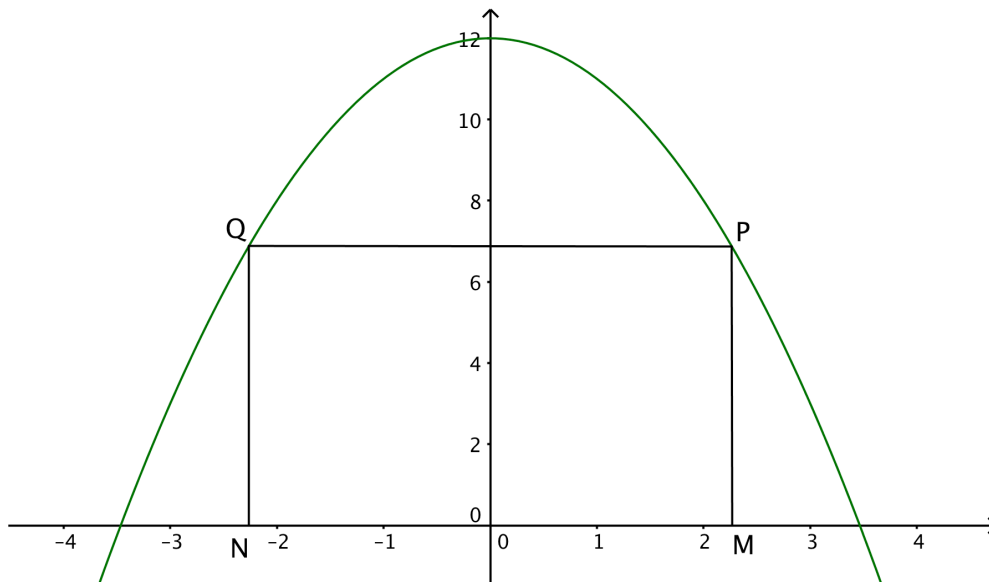
(2 marks)

- iv** find the probability that, given that the sum of the rolls is nine, one of the rolls is a three.

(2 marks)

Question 4 (11 marks)

A rectangle NMPQ drawn such that NM lies on the x -axis and vertices P and Q are points on the curve $y = 12 - x^2$. This is shown in the diagram below. All units are in centimetres.



The length of NM is $2x$ centimetres

a Given $M = (x, 0)$ find the length of MP in terms of x .

(1 mark)

b If the area of the rectangle is $A \text{ cm}^2$ show that $A = 24x - 2x^3$

(1 mark)

c i Find algebraically the exact coordinates, in the simplest form, of the x -intercepts for $y = 12 - x^2$.

(2 marks)

ii Hence state a reasonable domain for the area function found in part **b**.

- d** **i** Using your calculator, find the maximum possible area of the rectangle. (1 mark)

(1 mark)

- ii** Find the length and width of the rectangle when it has the maximum area.

(2 marks)

- e** Sketch a graph of A against x over a suitable domain. Label the coordinates of the axes intercepts and turning point. Any approximate values should be given to two decimal places.



(3 marks)

End of Section C

End of the Examination