Supervision Instructions

Mathematics Methods (Unit 1-2)
Task #7

30th of November 2022 – Period 4

Task consists of two papers: **Paper 1** and **Paper 2**. Students will have access to only one paper at a time.

Paper 1:
- 15 minutes
- Calculator is not allowed

After 15 minutes **Paper 1** is to be collected and **Paper 2** will be given.

Paper 2:
- 25 minutes
- Calculator is allowed

After 25 minutes **Paper 2** is to be collected.

Check that students put their names.

2022 Mathematical Methods (Unit 1-2)
Task 7
Paper 1 – Calculator not allowed

Number of marks: 10
Writing time: 15 minutes

Name: Marks:

Instructions

Answer **all** questions in the spaces provided.
In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

2 marks

Let $y=\frac{3}{2}x^2(4x+\frac{1}{\sqrt{x}})$. Find $\frac{dy}{dx}$.

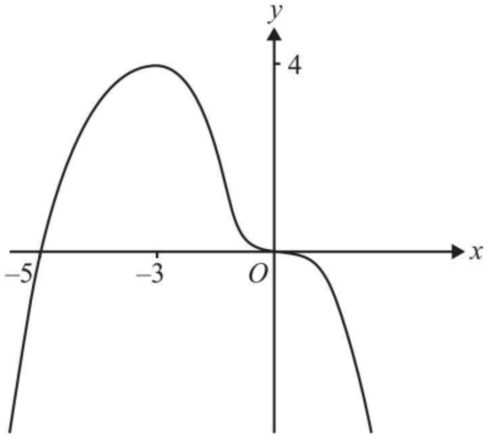
Question 2

2 marks

A particle moves in a straight line so that its displacement, x metres, from a fixed origin at time t seconds is given by $x=t^3-t^2-8t+9$. At what position is the particle temporarily at rest?

Question 3 2 marks

The graph of $f(x)$ is given. Sketch the graph of its derivative function on the same set of the axes shown below.



Question 4 3+1 marks

The point (2, 4) is a stationary point of the curve $y = ax^2 + bx$

i) Calculate the values *a* and *b*.

ii) State the nature of the stationary point by showing your work.

2022 Mathematical Methods (Unit 1-2)
Task 7

Paper 2 – Calculator allowed

Number of marks: 15
Writing time: 25 minutes

Name: Marks – Section 1: Section 2:

SECTION 1

Instructions for Section 1
Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
A correct answer scores 1, an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.

Question 1

The derivative of $f(x) = x^2 - 3x$ can be found from first principles by evaluating:

A. $\lim\limits_{h \to 0} \dfrac{(x+h)^2 - 3xh - x^2 - 3x}{h}$

B. $\lim\limits_{h \to 0} \dfrac{(x+h)^2 - 3(x+h)^2 - x^2 - 3x}{h}$

C. $\lim\limits_{h \to 0} \dfrac{(x+h)^2 - 3(x+h) - x^2 - 3x}{h}$

D. $\lim\limits_{h \to 0} \dfrac{(x+h)^2 - 3(x+h) - x^2 + 3x}{h}$

E. $\lim\limits_{h \to 0} \dfrac{(x+h)^2 - 3(x+h) - x^2 + 3xh}{h}$

Question 2

The coordinates of the point on the graph of $y = -x^2 - 2x$ at which the tangent is perpendicular to $y = \dfrac{x}{8} + 1$ is:

A. $(3, -8)$

B. $(3, -15)$

C. $(-3, \dfrac{11}{8})$

D. $(-3, \dfrac{1}{8})$

E. $(-3, 3)$

Question 3

If $y = x^2 - 5x - 24$, the interval(s) for which $\frac{dy}{dx} > 0$ is:

A. $x < -3$

B. $-3 < x < 8$

C. $x < \frac{5}{2}$

D. $x < -3 \cup x > 8$

E. $x > \frac{5}{2}$

Question 4

$$h(x) = \begin{cases} 1 - x^3, & x < -2 \\ 3, & x = -2 \\ x^2 + 5, & x > -2 \end{cases}$$

$\lim\limits_{x \to -2} h(x)$ is:

A. -2

B. 3

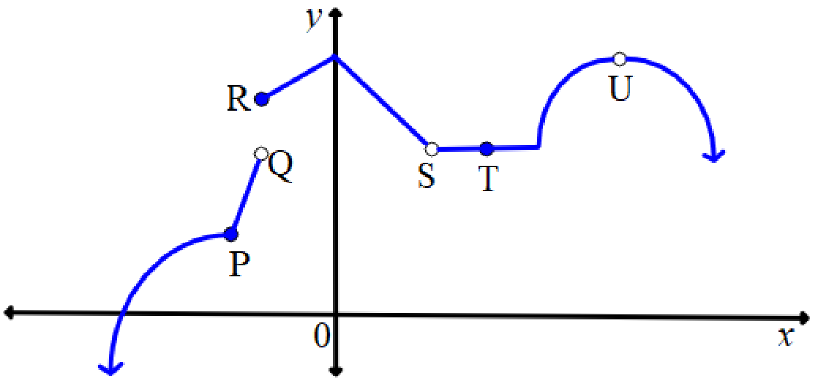
C. 8

D. 9

E. The limit does not exist.

Question 5

The graph below is differentiable at point(s):



A. P only

B. Q, S and U

C. T only

D. U only

E. Q and R

SECTION 2

Instructions for Section 2
Answer **all** questions in the spaces provided.
In all questions where a numerical answer is required, an exact value must be given unless otherwise specified.
In questions where more than one mark is available, appropriate working **must** be shown.
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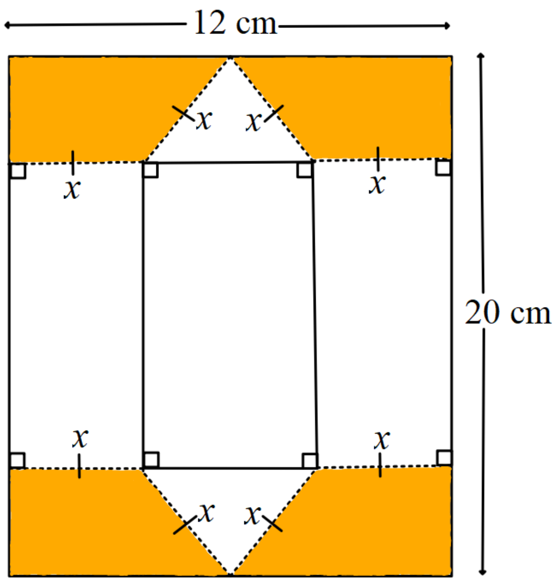
Question 1

A triangular prism shaped 'Toblerone' chocolate box is to be constructed from a rectangular sheet of cardboard measuring 20 cm by 12 cm as shown below. Equal lengths of x cm are cut along the dotted lines and remaining flaps are folded up.

a. Show that the height of the triangle is $h = \sqrt{12x - 36}$ — 2 marks



b. Find the restriction(s) on x. Show your work — 2 marks

c. Show that the volume of the box, V cm^3, is given by 2 marks

$V(x) = 2(6 - x)(10\sqrt{12x - 36} - (12x - 36))$

d. Use calculus to find the value of x for which the volume of the box is a maximum, correct to one decimal place. 2 marks

e. Sketch the graph of $V(x)$. Label any end points and stationary points with their coordinates correct to one decimal place. 2 marks