Supervision Instructions

Mathematics Methods (Unit 1-2)
Task #2
30th March 2021 – 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.

2021 Mathematical Methods (Unit 1-2)
Task 2

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

Solve the following equation $8x^2 - 22x + 12 = 0$, in simplest exact form.

$\Delta = (-22)^2 - 4 \times 8 \times 12$

$\Delta = 100$

1 mark working out (any method)

$x_1 = \frac{22}{16} + \frac{\sqrt{100}}{16} = \frac{32}{16} = 2$

$x_2 = \frac{22}{16} - \frac{\sqrt{100}}{16} = \frac{12}{16} = \frac{3}{4}$

1 mark - answers

Question 2

2 marks

Solve the quadratic inequality $-x^2 + 3x + 4 < 0$.

$-x^2 + 3x + 4 < 0$

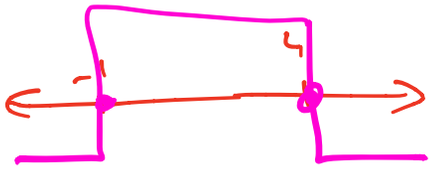
$-x \times 4$

$x \times 1$

$(-x+4)(x+1) < 0$

$x = 4 \quad x = -1$

1 mark



$x < -1$ or $x > 4$

$x < -1 \cup x > 4$

1 mark

Question 3

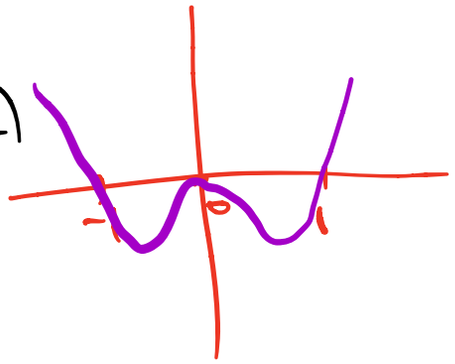
2 marks

Solve the inequality $x^4 - x^2 < 0$.

$x^2(x^2 - 1)$

$x^2(x-1)(x+1) < 0$

(1 mark working out)



$-1 < x < 1, \; x \neq 0$

(1 mark answer)

Question 4

a. Determine the x and y-intercepts of the cubic graph $y = -x^3 - 3x^2 + 16x + 48$. 3 marks

$P(-3) = 0$

$(x+3)(ax^2+bx+c) = -x^3 - 3x^2 + 16x + 48$

1 mark

$a = -1$

$b = 0$

$c = 16$

$3a + b = -3$

$-3 + b = -3$

$b = 0$

$(x+3)(-x^2+16)$ 1 mark

$(x+3)(-x+4)(x+4)$

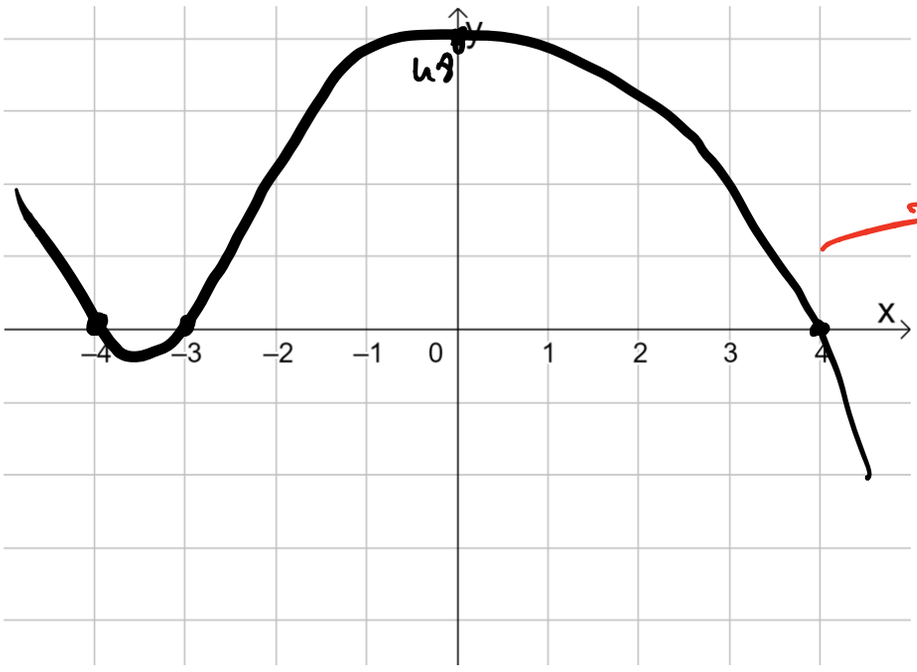
$(-3,0)\ (4,0)\ (-4,0)$

x-int

$(0,48)$ = y-int

1 mark

b. Hence sketch the graph, showing all intercepts with the coordinate axes. 1 mark



→ 1 mark

2021 Mathematical Methods (Unit 1-2)
Task 2

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

If x^3+3x^2-5x-p and $2x^3+2px^2-18$ have the same remainder when divided by $x-1$, then the value of p is

A. 4
B. 5
C. 6
D. 7
E. 8

$x-1=0$

$x=1$

$2+2p-18=1+3-5-p$

$\frac{3p}{3}=\frac{15}{3}$

$p=5$

Question 2

If the graphs $y=3x+1$ and $y=x^2-kx+5$ intersect at one point only, then k must be equal to

A. -7 or -1
B. 7 or -1
C. -1 or 6
D. -7 or 1
E. 1 or -6

$x^2-kx+5=3x+1$

$x^2-kx-3x+4$

$x^2-(k+3)x+4$

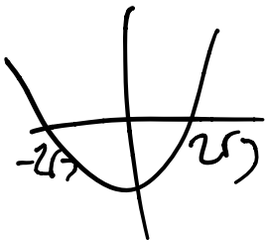
$\Delta=0=(k+3)^2-16=0$

$k=1$ or $k=-7$

Question 3

The quadratic equation $x^2 + ax + 3 = 0$ has no solution if

$\Delta = a^2 - 12 < 0$



A. $a = 3$

B. $-3 < a < 3$

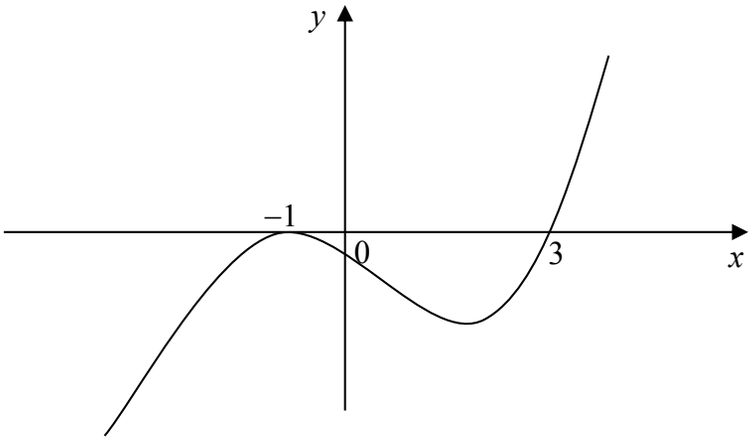
C. $a < -2\sqrt{3}$ or $a > 2\sqrt{3}$

D. $-2\sqrt{3} < a < 2\sqrt{3}$

E. $-\sqrt{3} < a < \sqrt{3}$

Question 4

The equation of the graph shown could be



A. $y = x(x-1)(x+3)$

B. $y = x(x+1)(x-3)$

C. $y = (x+1)^2(x-3)$

D. $y = (x+1)(x-3)^2$

E. $y = (x+1)^2(x-3)^2$

Question 5

The equation of the parabola that passes through the point (2, 11) and has its vertex at (–1, 4) is

A. $y = \frac{7}{9}(x+1)^2 + 4$

B. $y = (x+1)^2 + 4$

C. $y = (x-1)^2 + 4$

D. $y = (x-1)^2 - 4$

E. $y = \frac{7}{9}(x-1)^2 + 4$

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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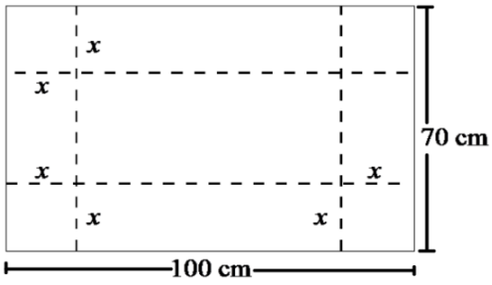
Question 1

An open box is constructed by cutting out square corners, with sides x cm, from a sheet of cardboard 100 cm by 70 cm as shown on the right and folding along the dotted line.



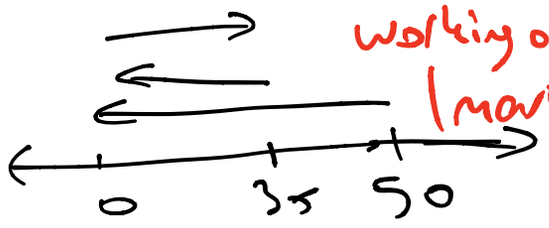
a. Show that the volume (cm^3) of the box can be expressed as $V = x(7000 - 340x + 4x^2)$. 2 mark

$x(100-2x)(70-2x)$] 1 mark

$= x(7000 - 200x - 140x + 4x^2)$

$= x(7000 - 340x + 4x^2)$] 1 mark

b. State the restrictions on the values of x. 2 marks



working out 1 mark

$x > 0$

$100 - 2x > 0$

$100 > 2x$

$50 > x$

$x < 50$

$70 - 2x > 0$

$70 > 2x$

$35 > x$

$x < 35$

$0 < x < 35$

answer 1 mark

Question2

Consider the equation $-0.27x^2 + bx - 6 = 0$.

a. Express the discriminant in terms of b. 1 mark

$\Delta = b^2 - 4ac$

$\Delta = b^2 - 6.48$ 1 mark

b. Find the values of b such that the equation will have only one solution. Give your answer correct to 2 decimal places. 2 marks

$b^2 - 6.49 = 0$ } 1 mark

$\sqrt{b^2} = \sqrt{6.49}$

$b = \pm 2.55$ or $b = 2.55$ (only +2.55 is 0 mark) (1 mark)

$b = -2.55$

c. Find the value(s) of x for which $-0.27x^2 + bx - 6 > 0$ if $b = 6$. Give your answer correct to 2 decimal places. 1 mark

$-0.27x^2 + 6x - 6 > 0$

$\Delta = 36 - 6.48$

$\Delta = 29.52$

$x_1 = \frac{6 \pm \sqrt{29.52}}{2 \times 0.27} = 1.05$ and 21.17

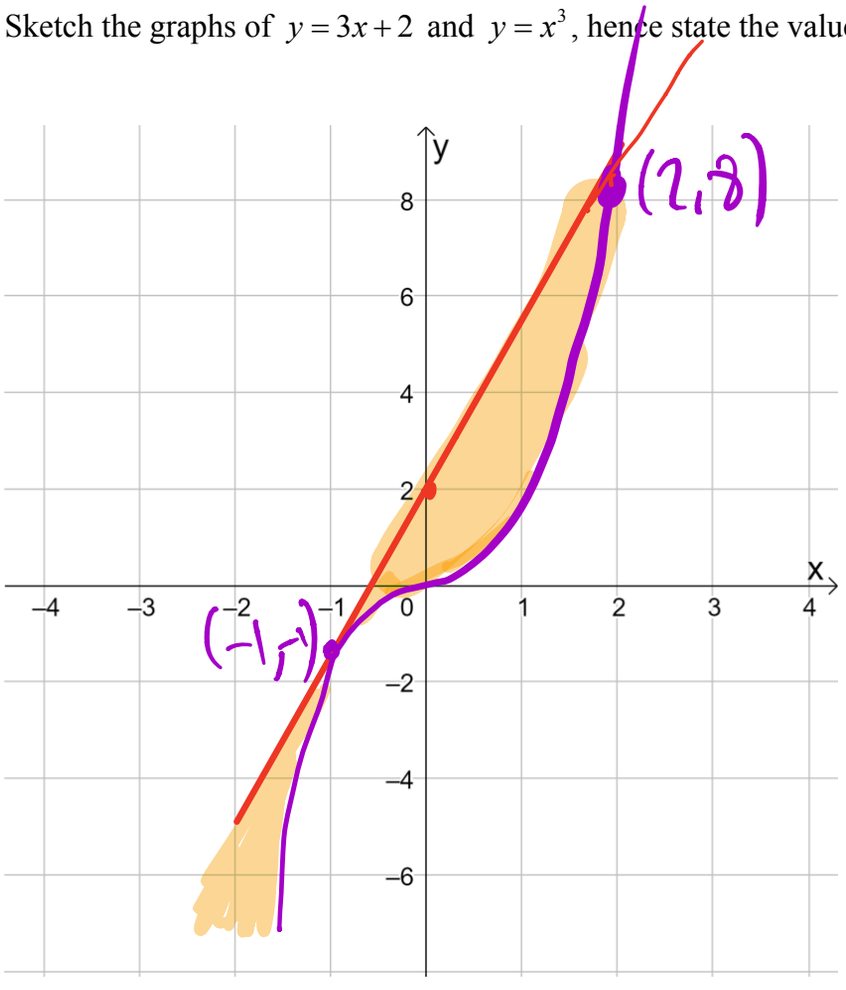
answer

$1.05 < x < 21.17$ (1 mark)

Question 3

2 marks

Sketch the graphs of $y = 3x + 2$ and $y = x^3$, hence state the values of x for $3x + 2 \geq x^3$.



$x \leq 2$