FINAL MARK

GIRRAWEEN HIGH SCHOOL
MATHEMATICS EXTENSION 1
2022
YEAR 11 Yearly Examination
ANSWERS COVER SHEET

Student Number: ______________________________

QUESTION	MARK	ME11-1	ME11-2	ME11-3	ME11-4	ME11-5	ME11-6	ME11-7
1-5	/5		✓					✓
6	/20		✓					✓
7	/23		✓					✓
8	/17		✓					✓
9	/28		✓					✓
10	/20					✓		✓
11	/19					✓		✓
TOTAL								
	/132		/93			/39		/132

Year 11 Mathematics Extension 1 outcomes

A student:

ME11-1 uses algebraic and graphical concepts in the modelling and solving of problems involving functions and their inverses

ME11-2 manipulates algebraic expressions and graphical functions to solve problems

ME11-3 applies concepts and techniques of inverse trigonometric functions and simplifying expressions involving compound angles in the solution of problems

ME11-4 applies understanding of the concept of a derivative in the solution of problems, including rates of change, exponential growth and decay and related rates of change

ME11-5 uses concepts of permutations and combinations to solve problems involving counting or ordering

ME11-6 uses appropriate technology to investigate, organise and interpret information to solve problems in a range of contexts

ME11-7 communicates making comprehensive use of mathematical language, notation, diagrams and graphs

GIRRAWEEN HIGH SCHOOL

YEAR 11 YEARLY EXAMINATION

2022

MATHEMATICS EXTENSION 1

Time allowed: Two hours

(Plus 10 minutes reading time)

Instructions:

- Write using black or blue pen.
- A reference sheet is provided.
- Calculators approved by NESA may be used.
- For Section I, indicate your answers by filling in the appropriate circle on the answer sheet provided.
- For questions in section II, show relevant mathematical reasoning and/or calculations. Each question is to be answered on a new page in your answer booklet. You may ask for extra booklets if you need them.
- All the graphs are to be drawn on the separate answer booklet provided.
- Marks may be deducted for careless or badly arranged work.

Section I Multiple Choice Questions 1 to 5 (5 marks)

Fill in the appropriate circle on your multiple choice answer sheet:

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1. Naveen has got 7 friends. Number of ways in which he can invite two or more of them for a party is

A. 127

B. 120

C. 21

D. 56

2. Simplify: $\frac{1}{n!}-\frac{1}{(n+1)!}$

A. $\frac{1}{n!\,(n+1)!}$

B. $\frac{n}{n!\,(n+1)!}$

C. $\frac{1}{(n+1)!}$

D. $\frac{n}{(n+1)!}$

3. When $P(x)=x^3+x^2+ax+a^2$ s divided by $(x-2)$, the remainder is 27. The possible values of a are

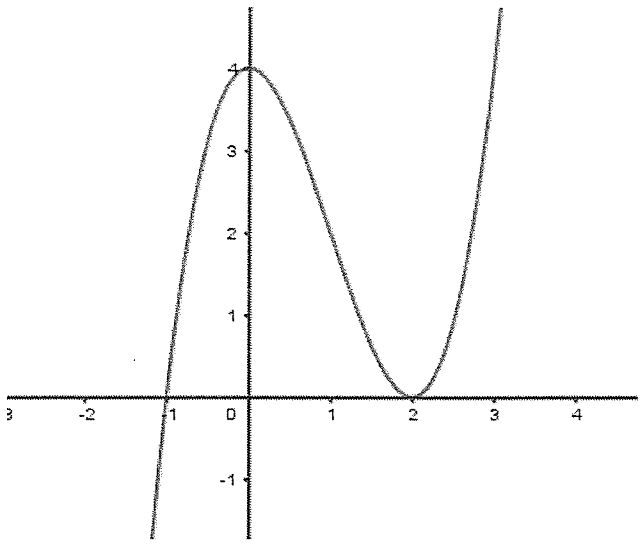
A. $a=-3$ or $a=5$

B. $a=3$ or $a=-5$

C. $a=3$ or $a=5$

D. $a=-3$ or $a=-5$

4. The diagram below shows the graph of a monic cubic polynomial $P(x)$.



The values of k such that the curve $y = P(x-k)$ passes through the origin are

A. $k=1$ or $k=-2$

B. $k=-1$ or $k=2$

C. $k=1$ or $k=2$

D. $k=-1$ or $k=-2$

5. Solve the inequality $(x+2)(2x+1)(x-3) \leq 0$

A. $x \leq -2$ or $-0.5 \leq x \leq 3$

B. $x \leq 2$ or $-0.5 \leq x \leq 3$

C. $x \leq -2$ or $0.5 \leq x \leq 3$

D. $x < 2$ or $-0.5 \leq x \leq 3$

END OF MULTIPLE CHOICE QUESTIONS

Section II

Show all necessary working in your examination booklet.

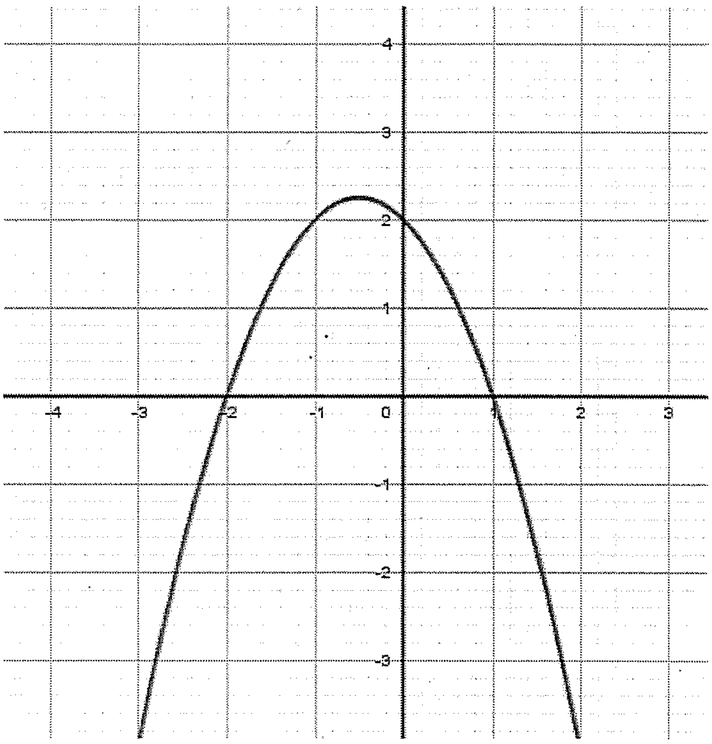
Question 6 (20 marks)

(a) Solve:

(i) $|4-2x| \geq 6$ **(ii)** $\dfrac{4x}{x+3} \leq 1$ 7

(b) A curve is represented by the following parametric equations $x = 5\tan\theta - 3$, $y = 9 + 4\sec\theta$. Find the cartesian equation of the curve. 4

(c) The diagram shows the graph of the function $f(x) = (x+2)(1-x)$.



Use the graph of $y = f(x)$ to draw graphs of the following transformations **on the separate answer booklet provided. Clearly show all intercepts with the axes, asymptotes and the final graph.**

(i) $y = \dfrac{1}{f(x)}$ 3

(ii) $y = |f(x)|$ **(iii)** $y = f(|x|)$ **(iv)** $|y| = f(x)$ 6

Question 7 (23 marks)

(a) Expand and simplify:

(i) $\left(1+\dfrac{2x}{5}\right)^5$ 3

(ii) $\left(x^2-2y^3\right)^7$ 4

(b) In the expansion of $\left(5x^2-\dfrac{1}{x}\right)^{18}$, find

(i) the coefficient of x^9. 3

(ii) the term independent of x. 2

(c) **(i)** Write the first six terms in the expansion of $(1+x)^{13}$. 2

(ii) Hence find the coefficient of x^5 in the expansion of $(2+x^3)(1+x)^{13}$ 2

(d) Solve for n where n is a positive integer.

$$^{n}C_2 + {}^{n+1}C_1 = 7$$ 3

(e) In the expansion of $(2+3x)^n$, the coefficient of x^4 and x^3 are in the ratio 15 : 8.

Find the value of n. 4

Examination continues on next page.

Question 8 (17 marks)

(a) **(i)** By expanding $(1+x)^n$ and using an appropriate substitution, show that

$${}^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \dots + {}^nC_n = 2^n$$ 3

(ii) By using an appropriate substitution in the expansion of $(1+x)^n$, show that

$${}^nC_0 + {}^nC_2 + {}^nC_4 + \dots = {}^nC_1 + {}^nC_3 + {}^nC_5 + \dots$$ 2

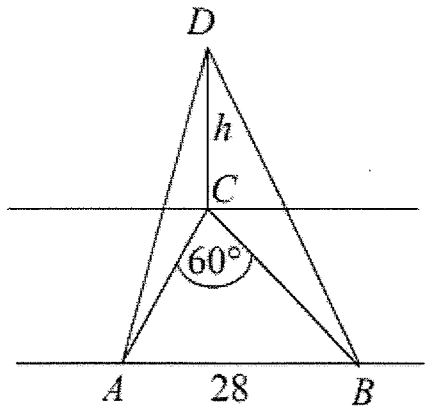
(iii) By differentiation, show that

$$1 \times {}^nC_1 + 2 \times {}^nC_2 + 3 \times {}^nC_3 + 4 \times {}^nC_4 + \dots + n \times {}^nC_n = n \times 2^{n-1}$$ 2

(iv) Using **(i)** and **(iii)**, show that

$$1 \times {}^nC_0 + 2 \times {}^nC_1 + 3 \times {}^nC_2 + 4 \times {}^nC_3 + \dots + (n+1) \times {}^nC_n = (n+2) \times 2^{n-1}$$ 2

(b) A canal has two parallel sides. A vertical pole CD of height h metres stands with its base at C on one edge of the canal. A and B are two points on the other edge of the canal such that $AB = 28$ metres and $\angle ACB = 60°$. From A and B the angles of elevation of the top D of the pole are α and β respectively, where $\tan\alpha = \frac{1}{3}$ and $\tan\beta = \frac{1}{8}$.



(i) Use the cosine rule to show that the height of the pole is 4 metres. 4

(ii) Find the area of ΔACB. 2

(iii) Hence find the width of the canal in simplest exact form. 2

Question 9 (28 marks)

(a) If α, β and γ are the roots of $2x^3 - x^2 + x - 3 = 0$, find the value of:

(i) $\alpha + \beta + \gamma$ **1**

(ii) $\alpha\beta + \alpha\gamma + \beta\gamma$ **1**

(iii) $\alpha\beta\gamma$ **1**

(iv) $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$ **2**

(v) $\alpha^2\beta\gamma + \alpha\beta^2\gamma + \alpha\beta\gamma^2$ **2**

(vi) $\alpha^2 + \beta^2 + \gamma^2$ **2**

(b) The polynomial $P(x) = x^4 - 3x^3 - 6x^2 + 28x - 24 = 0$ has a root of multiplicity three.

(i) Find the triple zero using derivatives of $P(x)$. 4

(ii) Find the remaining simple zero. 2

(iii) Factorise $P(x)$. 2

(iv) Sketch the graph of $y = P(x)$ showing all intercepts with the axes. 4

(On the separate answer booklet)

(c) The polynomial $P(x) = 2x^3 + ax^2 + bx + 5$ leaves a remainder of 5 when divided by $(x-1)$. The derived polynomial $P'(x)$ also leaves a remainder of 5 when divided by $(x-1)$. Find the values of a and b. 3

(d) Solve the equation $4x^3 + 32x^2 + 79x + 60 = 0$ given that one root is the sum of the other two, using sum and product of roots. 4

Question 10 (20 marks)

(a) How many different words can be formed by taking all the letters of the word EQUATION so that

(i)	the words begin with E.	1
(ii)	the words begin with E and end with N.	1
(iii)	the words begin and end with a consonant.	2

(b) A committee of 6 is to be chosen from 7 boys and 8 girls. How many different committees can be formed if

(i)	there are no restrictions.	2
(ii)	the committees must have 4 boys and 2 girls.	2
(iii)	there must be a majority of boys.	2
(iv)	Tania will not go on the committee if Tom is on the committee.	3

(c) How many arrangements of the letters of the word UNNIKUTTAN are there with

(i)	no restrictions.	2
(ii)	all the N's are together.	2
(iii)	no N's are together	3

Examination continues on next page.

Question 11 (19 marks)

(a) There are two mathematics books and 5 novels to be placed on a shelf at random. Determine the probability that the mathematics books are next to each other. 3

(b) A meeting is arranged for 24 students along two sides of a long table with 12 chairs on each side. In how many ways the 24 students can be seated if six students wish to sit on one particular side and four on the other side. (leave your answer in unsimplified form) 3

(c) In how many ways can 6 boys and 6 girls be arranged in a circle if

(i) there are no restrictions. 2

(ii) boys and girls alternate. 2

(iii) two particular boys want to be together. 2

(iv) a particular boy wants to be opposite to a particular girl. 2

(v) two particular girls do not want to sit next to each other. 2

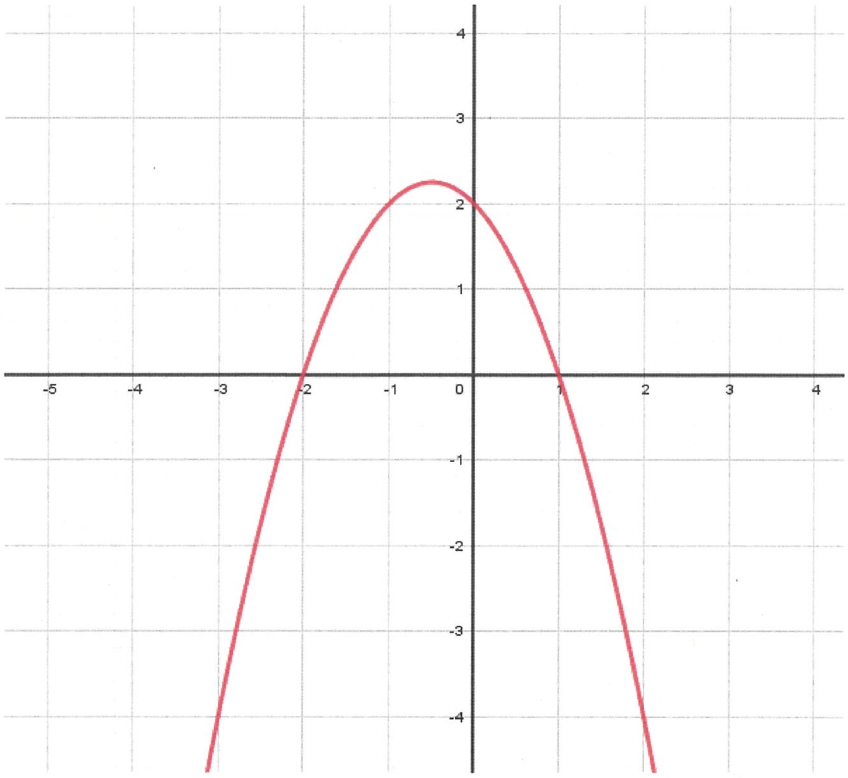
(d) The long-term car park at the airport has 1024 cars, in sections labelled A,B,C…M. Find the minimum number of cars parked in at least one of the sections. 2

(e) A school has 9 different sports for its weekly sports afternoon. How many students would you need to survey to ensure that at least 2 of them are from the same sporting group? 1

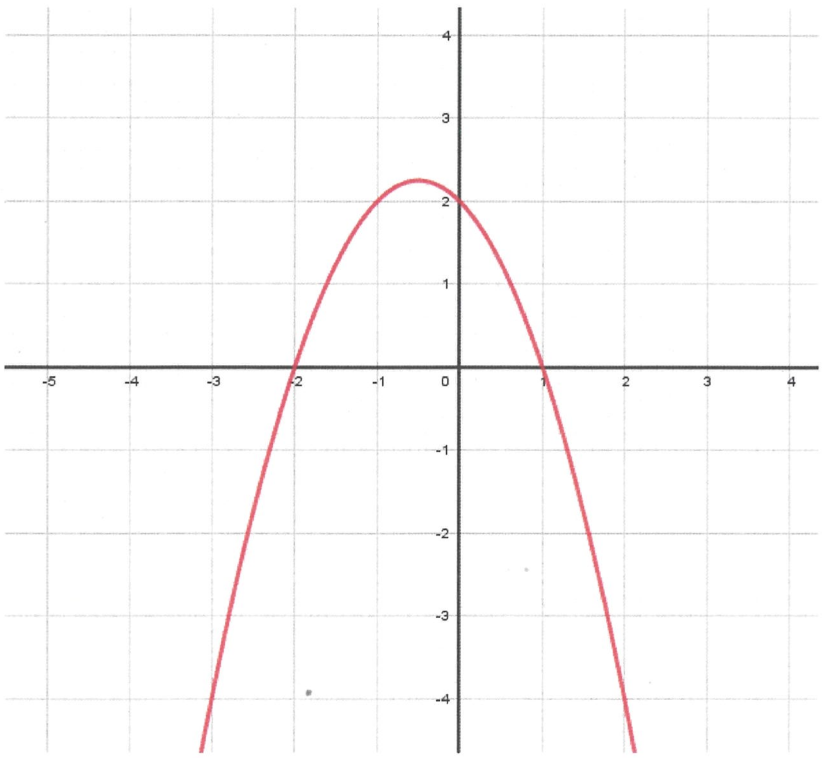
END OF QUESTION PAPER

Question 6(c) The graph of $y = (x+2)(1-x)$ is drawn for below.

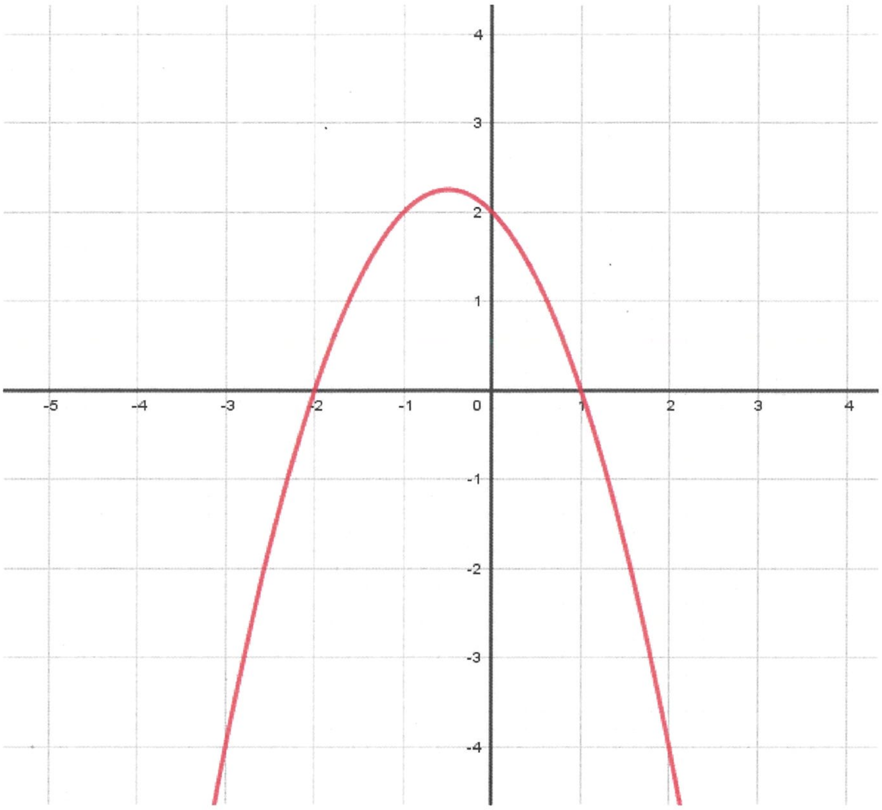
(i) Sketch $y = \dfrac{1}{f(x)}$



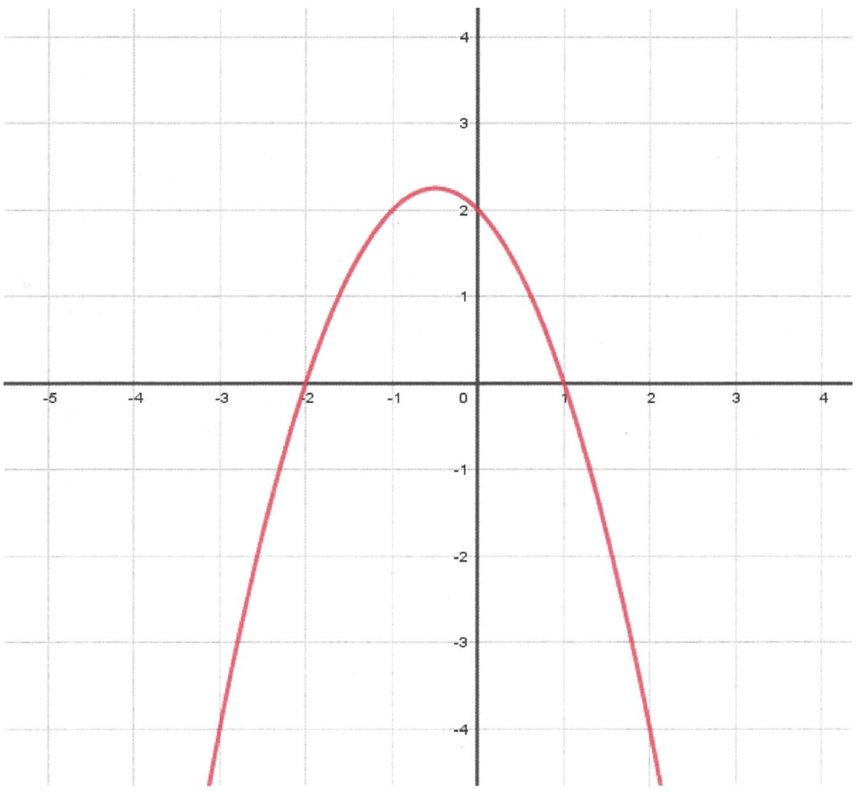
(ii) Sketch $y = |f(x)|$



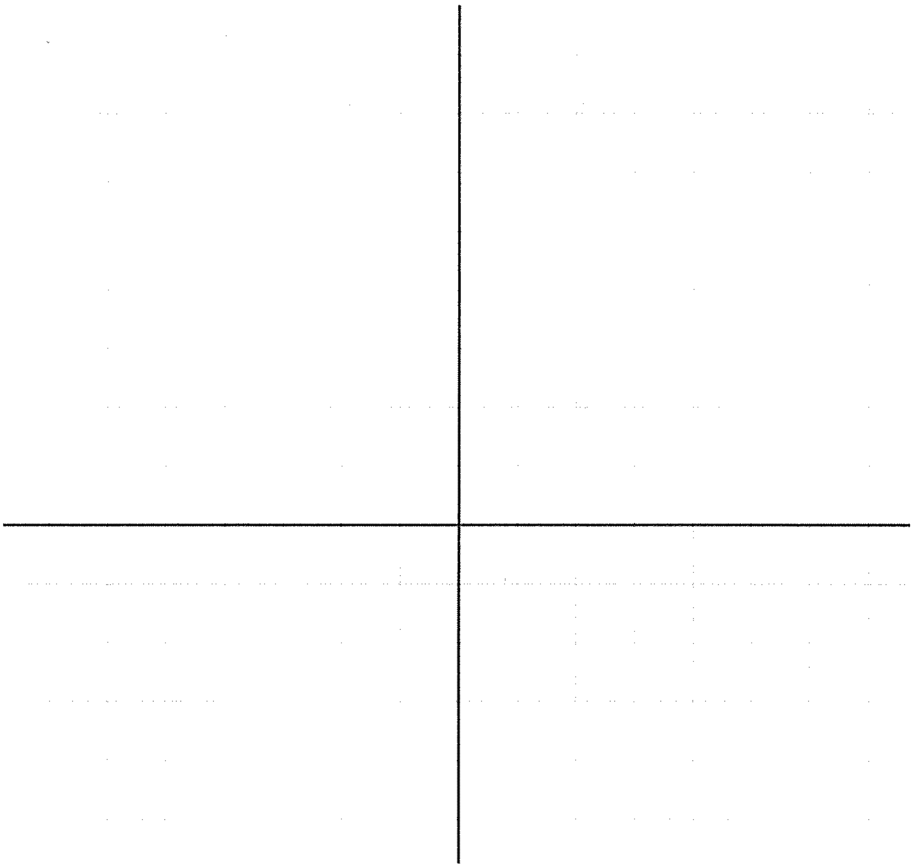
(iii) Sketch $y = f(|x|)$



(iv) Sketch $|y| = f(x)$



Question 9b(iv)



Year 11 Extension 1 Yearly Solutions - 2022

1. $^7C_2 + {}^7C_3 + {}^7C_4 + {}^7C_5 + {}^7C_6 + {}^7C_7 = 120$ (B)

2. $\dfrac{n+1-1}{(n+1)!} = \dfrac{n}{(n+1)!}$ (D)

3. $p(2) = 27$

$a^2 + 2a + 12 = 27$

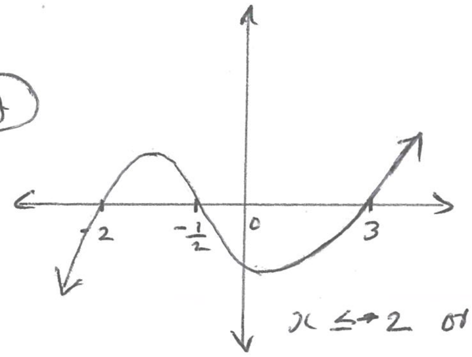
$a^2 + 2a - 15 = 0$ (B)

$(a+5)(a-3) = 0$

$a = 3, -5$

4. (A)

5. (A)



$x \le -2$ or $-0.5 \le x \le 3$

Question 6 (20 marks)

(a)(i) $|4 - 2x| \ge 6$

$4 - 2x \ge 6$ or $4 - 2x \le -6$

$4 - 6 \ge 2x$ $\qquad$ $4 + 6 \le 2x$ (3)

$\underline{x \le -1}$ $\qquad$ $\underline{x \ge 5}$

(ii) $\dfrac{4x}{x+3} \ge 1$

$(x+3)^2 \dfrac{4x}{x+3} \le (x+3)^2, x \ne -3$

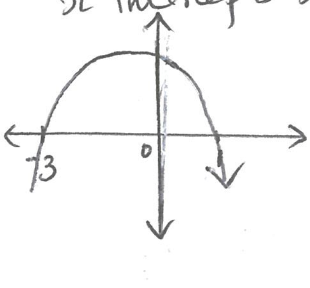
$(x+3)^2 \ge 4x(x+3)$

$(x+3)^2 - 4x(x+3) \ge 0$

$(x+3)(x+3-4x) \ge 0$

$(x+3)(3-3x) \ge 0$ (4)

x intercepts $x = -3$ or $x = 1$



From graph $-3 \le x \le 1$

But $x \ne -3$

$\underline{-3 < x \le 1}$

(b) $x = 5\tan\theta - 3$

$5\tan\theta = x + 3$

$\tan^2\theta = \dfrac{(x+3)^2}{25}$

$y = 9 + 4\sec\theta$

$4\sec\theta = y - 9$

$\sec\theta = \dfrac{y-9}{4}$

$\sec^2\theta = \dfrac{(y-9)^2}{16}$

$\sec^2\theta - \tan^2\theta = 1$ (4)

$\underline{\dfrac{(y-9)^2}{16} - \dfrac{(x+3)^2}{25} = 1}$

(c) Refer to Answer paper for sketching graph questions.

(9)

Question 7 (23 marks)

(a) (i) $\left(1+\frac{2x}{5}\right)^5$

$= 1 + {}^5C_1\left(\frac{2x}{5}\right) + {}^5C_2\left(\frac{2x}{5}\right)^2 + {}^5C_3\left(\frac{2x}{5}\right)^3 + {}^5C_4\left(\frac{2x}{5}\right)^4 + \left(\frac{2x}{5}\right)^5$

$= 1 + 2x + \frac{8x^2}{5} + \frac{16x^3}{25} + \frac{16x^4}{125} + \frac{32x^5}{3125}$ (3)

(ii) $(x^2 - 2y^3)^7$

$= (x^2)^7 - {}^7C_1(x^2)^6(2y^3) + {}^7C_2(x^2)^5(2y^3)^2 - {}^7C_3(x^2)^4(2y^3)^3 + {}^7C_4(x^2)^3(2y^3)^4 - {}^7C_5(x^2)^2(2y^3)^5 + {}^7C_6(x^2)(2y^3)^6 - (2y^3)^7$

$= x^{14} - 7\times x^{12}\times 2y^3 + 21x^{10}\times 4y^6 - 35x^8\times 8y^9 + 35x^6\times 16y^{12} - 21x^4\times 32y^{15} + 7x^2\times 64y^{18} - 128y^{21}$

$= x^{14} - 14x^{12}y^3 + 84x^{10}y^6 - 280x^8y^9 + 560x^6y^{12} - 672x^4y^{15} + 448x^2y^{18} - 128y^{21}$ (4)

b (i) $\left(5x^2 - \frac{1}{x}\right)^{18}$

$T_{r+1} = (-1)^r\, {}^{18}C_r (5x^2)^{18-r}\left(\frac{1}{x}\right)^r$

$= (-1)^r\, {}^{18}C_r\, 5^{18-r}\, x^{36-2r} \times \frac{1}{x^r}$

$= (-1)^r\, {}^{18}C_r\, 5^{18-r}\, x^{36-3r}$

For coefficient of x^9, $36-3r=9$

$r = 9$

Coefficient of x^9

$= (-1)^9\, {}^{18}C_9\, 5^{18-9}$

$= -{}^{18}C_9 \times 5^9$ (3)

(ii) For the terms independent of x,

$$36 - 3r = 0$$
$$36 = 3r$$
$$r = 12$$

2

$$T_{13} = (-1)^{12}\ {}^{18}C_{12}\ 5^{18-12}\ x^{0}$$
$$= \underline{\underline{{}^{18}C_{12} \times 5^{6}}}$$

(c) (i) $(1+x)^{13} = 1 + {}^{13}C_1 x + {}^{13}C_2 x^2 + {}^{13}C_3 x^3 + {}^{13}C_4 x^4 + {}^{13}C_5 x^5$
$+ \cdots$

2

(ii) $(2+x^3)(1+x)^{13}$

$= (2+x^3)(1 + {}^{13}C_1 x + {}^{13}C_2 x^2 + {}^{13}C_3 x^3 + {}^{13}C_4 x^4 + {}^{13}C_5 x^5 + \cdots)$

Terms containing x^5

$$2 \times {}^{13}C_5\, x^5 + x^3 \times {}^{13}C_2\, x^2$$

2

Coefficient of $x^5 = 2 \times {}^{13}C_5 + {}^{13}C_2 = \underline{\underline{2652}}$

(d) ${}^{n}C_2 + {}^{n+1}C_1 = 7$

$$\frac{n(n-1)}{1\times 2} + n + 1 = 7$$

$$n^2 - n + 2n + 2 = 14$$

3

$$n^2 + n - 12 = 0$$
$$(n+4)(n-3) = 0$$
$$n = 3 \text{ or } n = -4$$
$$\underline{\underline{n = 3 \ (\because n > 0)}}$$

(c)

$$(2+3x)^n = 2^n + {}^nC_1\,2^{n-1}(3x) + {}^nC_2\,2^{n-2}(3x)^2 + {}^nC_3\,2^{n-3}(3x)^3 + {}^nC_4\,2^{n-4}(3x)^4 + \cdots$$

$$\frac{{}^nC_4\,2^{n-4}\,3^4}{{}^nC_3\,2^{n-3}\,3^3} = \frac{15}{8}$$

$$\frac{{}^nC_4}{{}^nC_3} \times \frac{3}{2} = \frac{15}{8}$$

$$\left[\frac{n(n-1)(n-2)(n-3)}{1\times2\times3\times4} \times \frac{1\times2\times3}{n(n-1)(n-2)}\right] \times \frac{3}{2} = \frac{15}{8}$$

$$\frac{3(n-3)}{8} = \frac{15}{8}$$

4

$$3n-9 = 15$$

$$3n = 24$$

$$\underline{\underline{n = 8}}$$

Question 8 (17 marks)

(a)(i) $(1+x)^n = 1 + {}^nC_1 x + {}^nC_2 x^2 + {}^nC_3 x^3 + \cdots + {}^nC_n x^n$ 1

Substitute $x = 1$ 3

$$2^n = 1 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \cdots + {}^nC_n$$

$$\underline{\underline{{}^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \cdots + {}^nC_n = 2^n}} \quad (\because {}^nC_0 = 1)$$

(ii) substitute $x = -1$

$$0 = 1 - {}^nC_1 + {}^nC_2 - {}^nC_3 + \cdots + (-1)^n\,{}^nC_n$$

$$0 = {}^nC_0 - {}^nC_1 + {}^nC_2 - {}^nC_3 + \cdots + (-1)^n\,{}^nC_n$$ 2

$$\underline{\underline{{}^nC_0 + {}^nC_2 + {}^nC_4 = {}^nC_1 + {}^nC_3 + {}^nC_5 + \cdots}}$$

(iii) $(1+x)^n = 1 + {}^nC_1x + {}^nC_2x^2 + {}^nC_3x^3 + \dots + {}^nC_nx^n$ — (1)

differentiating (1) we have

$n(1+x)^{n-1} = {}^nC_1 + {}^nC_2 \times 2x + {}^nC_3 \times 3x^2 + \dots + {}^nC_n \times n\,x^{n-1}$

Substitute $x = 1$ (2)

$n \times 2^{n-1} = {}^nC_1 + 2 \times {}^nC_2 + 3 \times {}^nC_3 + \dots + n \times {}^nC_n$ — (2)

(iv) From (i)

$${}^nC_0 + {}^nC_1 + {}^nC_2 + {}^nC_3 + \dots + {}^nC_n = 2^n \text{ — (3)}$$

Adding (2) and (3) (2)

$${}^nC_0 + 2\,{}^nC_1 + 3 \times {}^nC_2 + 4 \times {}^nC_3 + \dots + (n+1)\,{}^nC_n = 2^n + n \times 2^{n-1}$$

$$\text{ie } {}^nC_0 + 2 \times {}^nC_1 + 3 \times {}^nC_2 + 4 \times {}^nC_3 + \dots + (n+1) \times {}^nC_n = 2^{n-1}(n+2)$$

(b) (i) $\tan\alpha = \dfrac{h}{AC}$

$\dfrac{1}{3} = \dfrac{h}{AC}$

$AC = 3h$

$\tan\beta = \dfrac{h}{BC}$

$\dfrac{1}{8} = \dfrac{h}{BC}$

$BC = 8h$

Apply cosine rule in ΔACB,

$AB^2 = AC^2 + BC^2 - 2 \times AC \times BC \times \cos 60$

$28^2 = (3h)^2 + (8h)^2 - 2 \times 3h \times 8h \times \frac{1}{2}$

$28^2 = 9h^2 + 64h^2 - 24h^2$ (4)

$49h^2 = 28^2$

$h^2 = \dfrac{28 \times 28}{49} = 16$

$h = 4$ metres.

(ii) Area of ΔACB

$= \frac{1}{2} \times AC \times BC \times \sin 60$

$= \frac{1}{2} \times 12 \times 32 \times \frac{\sqrt{3}}{2}$ (2)

$= 96\sqrt{3}\ m^2$

(iii) Let w be the width

$96\sqrt{3} = \frac{1}{2} \times 28 \times w$

$w = \dfrac{96\sqrt{3}}{14}$ (2)

$= \dfrac{48\sqrt{3}}{7}$ metres

Question 9 (28 marks)

(a) $2x^3 - x^2 + x - 3 = 0$

(i) $\alpha + \beta + \gamma = \frac{-(-1)}{2} = \frac{1}{2}$ (1)

(ii) $\alpha\beta + \alpha\gamma + \beta\gamma = \frac{1}{2}$ (1)

(iii) $\alpha\beta\gamma = \frac{-(-3)}{2} = \frac{3}{2}$ (1)

(iv) $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma} = \frac{\beta\gamma + \alpha\gamma + \alpha\beta}{\alpha\beta\gamma}$

$= \frac{1}{2} \div \frac{3}{2} = \frac{1}{2} \times \frac{2}{3}$

$= \frac{1}{3}$ (2)

(v) $\alpha^2\beta\gamma + \alpha\beta^2\gamma + \alpha\beta\gamma^2$

$= \alpha\beta\gamma(\alpha + \beta + \gamma)$

$= \frac{3}{2} \times \frac{1}{2} = \frac{3}{4}$ (2)

(vi) $\alpha^2 + \beta^2 + \gamma^2 =$

$= (\alpha + \beta + \gamma)^2 - 2(\alpha\beta + \alpha\gamma + \beta\gamma)$

$= \left(\frac{1}{2}\right)^2 - 2 \times \frac{1}{2}$ (2)

$= \frac{1}{4} - 1 = \frac{-3}{4}$

(b) $P(x) = x^4 - 3x^3 - 6x^2 + 28x - 24$

$P'(x) = 4x^3 - 9x^2 - 12x + 28$

$P''(x) = 12x^2 - 18x - 12$

$P''(x) = 0$

$12x^2 - 18x - 12 = 0$

$6(2x^2 - 3x - 2) = 0$

$2x^2 - 3x - 2 = 0$

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

$x = 2$ or $x = -\frac{1}{2}$ (4)

$P(2) = 16 - 24 - 24 + 56 - 24 = 0$

$\therefore x = 2$ is the root of multiplicity 3.

(ii) Let α be the zero

$\alpha + 2 + 2 + 2 = \frac{-(-3)}{1} = 3$

$\alpha + 6 = 3$ (2)

$\alpha = -3$

(iii) $P(x) = (x-2)^3(x+3)$ (2)

(iv) Refer to Answers booklet.

(4)

(c) $p(x) = 2x^3 + ax^2 + bx + 5$

$p'(x) = 6x^2 + 2ax + b$

$p(1) = 5$ and $p'(1) = 5$

$2 + a + b + 5 = 5$ | $6 + 2a + b = 5$

$a + b = -2$ | $2a + b = -1$

$a + b = -2$

$2a + b = -1$

$a = 1$

(3)

$b = -2 - a$
$= -2 - 1$
$= -3$

$\underline{\underline{a = 1,\ b = -3}}$

(d) Let the roots be α, β and $\alpha + \beta$

Sum of roots

$\alpha + \beta + \alpha + \beta = \frac{-32}{4}$

$\alpha + \beta = -4$ — (1)

Product of roots

$\alpha\beta(\alpha + \beta) = -15$

$-4\alpha\beta = -15$

$\alpha\beta = \frac{15}{4}$

From (1) $\beta = -4 - \alpha$

substitute in (2)

$\alpha(-4 - \alpha) = \frac{15}{4}$

$-4\alpha - \alpha^2 = \frac{15}{4}$

$-16\alpha - 4\alpha^2 = 15$

$4\alpha^2 + 16\alpha + 15 = 0$

$(2\alpha + 5)(2\alpha + 3) = 0$

$\alpha = \frac{-5}{2}$ or $\alpha = \frac{-3}{2}$

$\alpha = \frac{-5}{2}$

$\beta = -4 - \alpha = \frac{-3}{2}$ (4)

$\alpha = \frac{-3}{2}$

$\beta = -4 + \frac{3}{2} = \frac{-5}{2}$

$\therefore$ the roots are

$\underline{\underline{-4,\ \frac{-3}{2},\ \frac{-5}{2}}}$

Question 10 (20 marks)

(a) (i) $1 \times 7! = 5040$ (1)

(ii) $1 \times 1 \times 6! = 720$ (1)

(iii) $3 \times 2 \times 6! = 4320$ (2)

(b) (i) ${}^{15}C_6 = 5005$ (2)

(ii) ${}^{7}C_4 \times {}^{8}C_2 = 980$ (2)

(iii) 4B 2G — 7 boys
5B 1G — 8 girls
6B

$= ({}^{7}C_4 \times {}^{8}C_2) + ({}^{7}C_5 \times {}^{8}C_1) + {}^{7}C_6$

$= 980 + 168 + 7$ (2)

$= \underline{1155}$

(iv) Number of ways of forming the committee with Tom (Tom is chosen, Tania out)

$= {}^{13}C_5 = 1287$

Number of ways of forming committees without Tom $= {}^{14}C_6 = 3003$

Total $= {}^{13}C_5 + {}^{14}C_6$ (3)

$= \underline{4290}$

Alternative method

Total − numbers of committees in which both Tania and Tom are present

$= 5005 - {}^{13}C_4$

$= 5005 - 715 = \underline{4290}$

(c) UNNIKUTTAN (1 2 3 4 5 6 7 8 9 10)

U − 2
N − 3
I − 1
K − 1
T − 2
A − 1

(i) $\dfrac{10!}{2! \times 3! \times 2!}$ (2)

$= \underline{151200}$

(ii) $\dfrac{8!}{2! \times 2!} = \underline{10080}$ (2)

(iii) $\dfrac{7!}{2! \times 2!} \times \dfrac{8 \times 7 \times 6}{3!} = \underline{70560}$ (3)

Question 11 (19 marks)

(a) $\frac{6! \times 2}{7!} = \frac{2}{7}$ 3

(b) 6 students in $12 \times 11 \times 10 \times 9 \times 8 \times 7$ ways

4 students in $12 \times 11 \times 10 \times 9$ ways

remaining 14 in $14!$ ways 3

Total number of arrangements

$= 12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 12 \times 11 \times 10 \times 9 \times 14!$

(c) (i) $11! = 39916800$ 2

(ii) $5! \times 6! = 86400$ 2

(iii) $10! \times 2! = 7257600$ 2

(iv) $10! = 3628800$ 2

(v) $9! \times 10 \times 9 = 32659200$ 2

OR

$11! - 10! \times 2! = 32659200$

(d) 13 sections

$\frac{1024}{13} = 78.8$ 2

Minimum number of cars parked in atleast one of the sections $= 79$

(e) There are 9 pigeonholes. The mapping becomes not 1-1 if we choose 10 pigeons 1

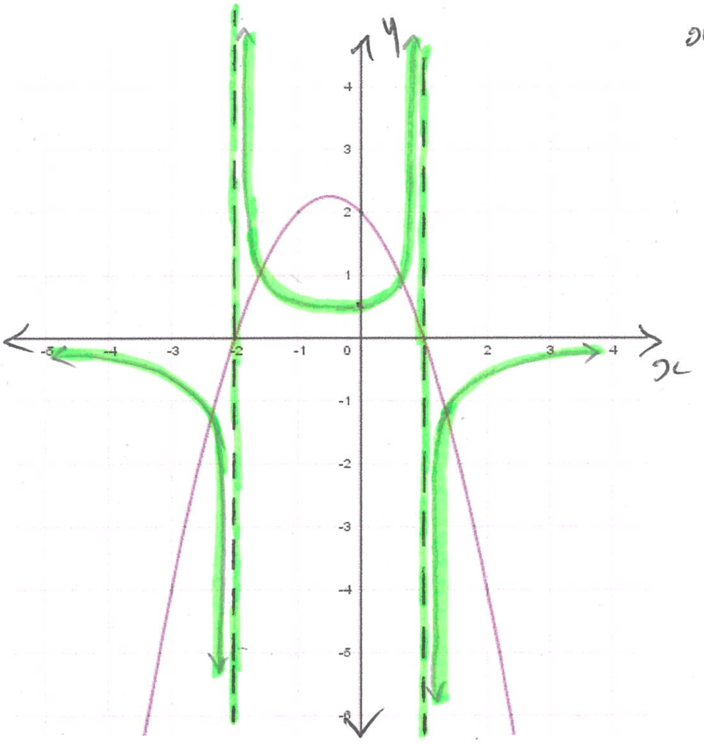
10 students.

Answer paper for sketching graph questions

Question 6(c) (i) $y = \dfrac{1}{f(x)}$

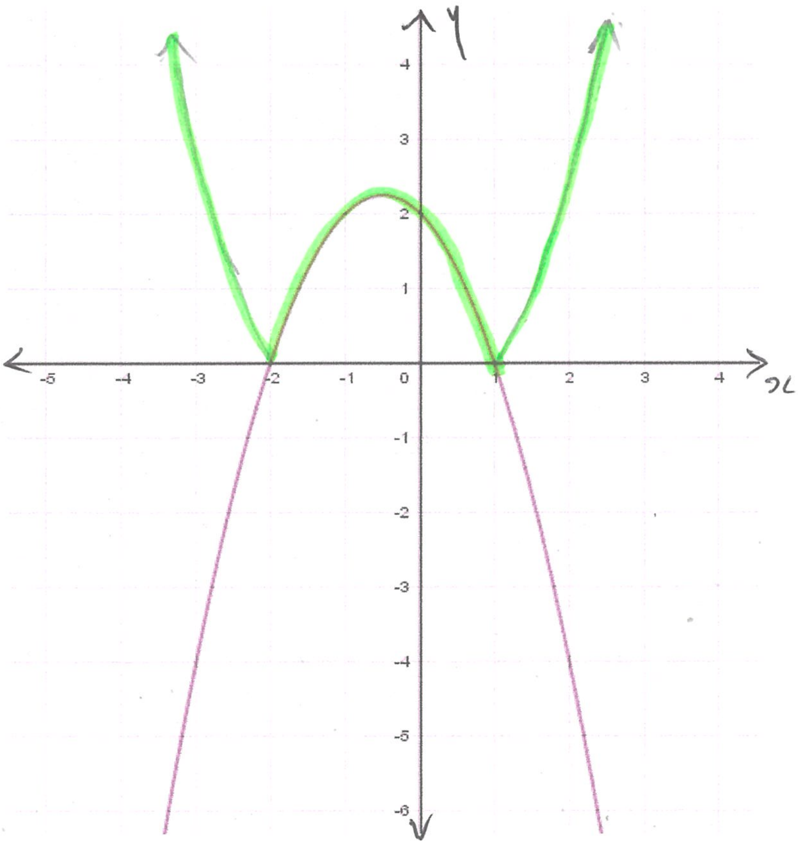
$y = \dfrac{1}{(x+2)(1-x)}$

$x = 0,\ y = \dfrac{1}{2}$



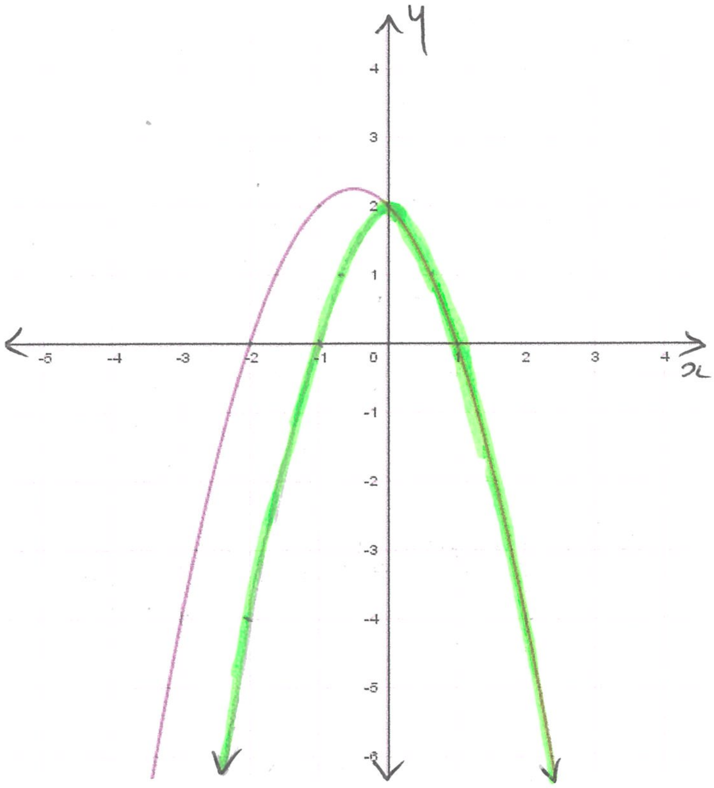
3

(ii) $y = |f(x)|$



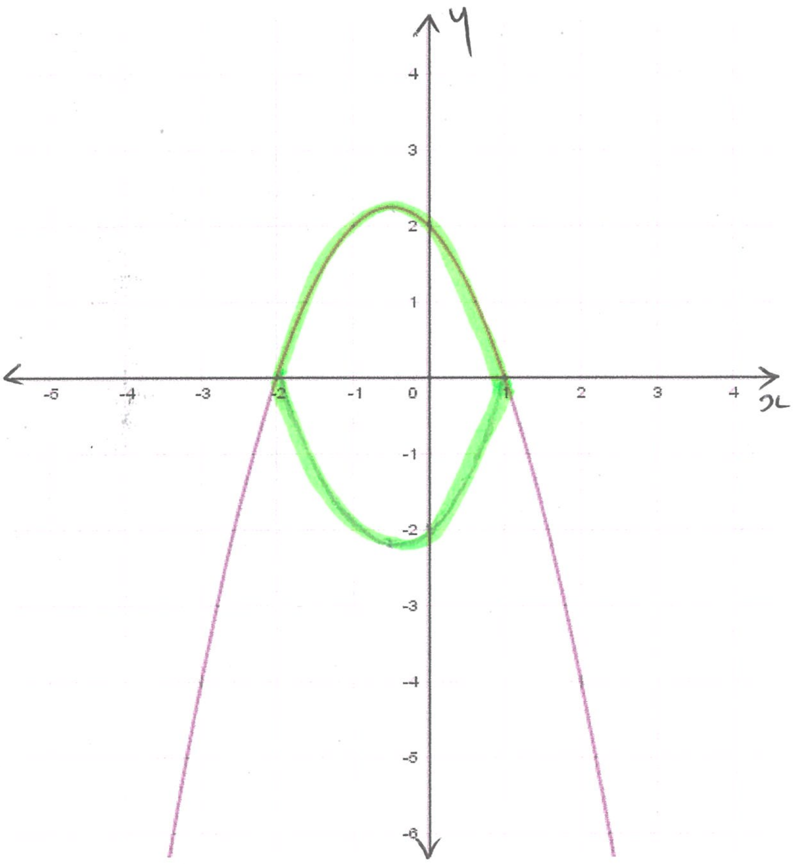
2

(iii) $y = f(|x|)$



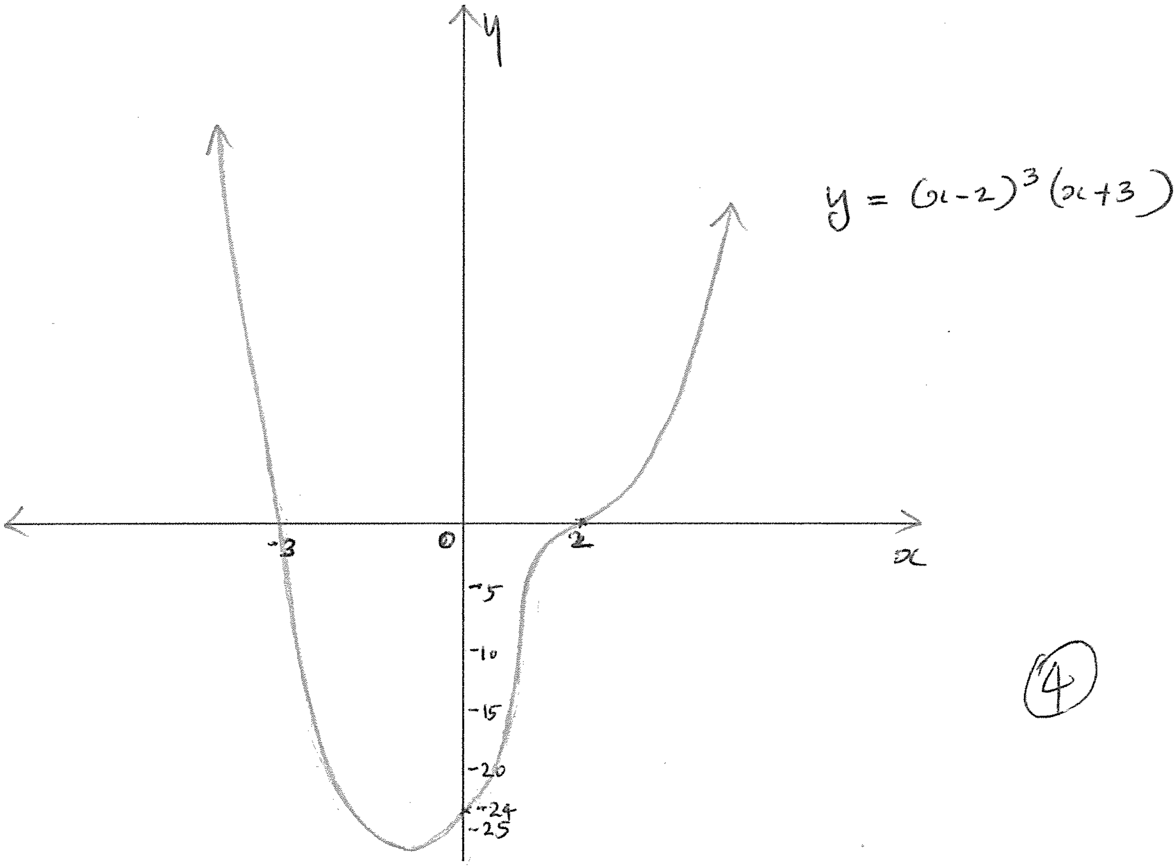
(2)

(iv) $|y| = f(x)$



(2)

Question 9b(iv)



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