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VCE Specialist Mathematics ½

AOS 1 Revision [1.0]

**SAC 1 Solutions**

**40 Marks. 5 Minutes Reading. 40 Minutes Writing.**

## Section A: SAC Questions (40 Marks)

### Question 1 (6 marks)

- a. If  $|x| = 5$ , find the possible values of  $|2x + 3|$ . (1 mark)

13 and 7

- b. Solve the equation  $2|x| - 3 = 2$ . (1 mark)

$x = \pm \frac{5}{2}$

- c. Solve the inequality  $|2x + 1| < 5$ . (1 mark)

$-3 < x < 2$

- d. Solve the equation  $|x^2 - 4x + 1| = 4$ . (3 marks)

$x = -(\sqrt{5} - 2)$  or  $x = 1$  or  $x = 3$  or  $x = \sqrt{5} + 2$

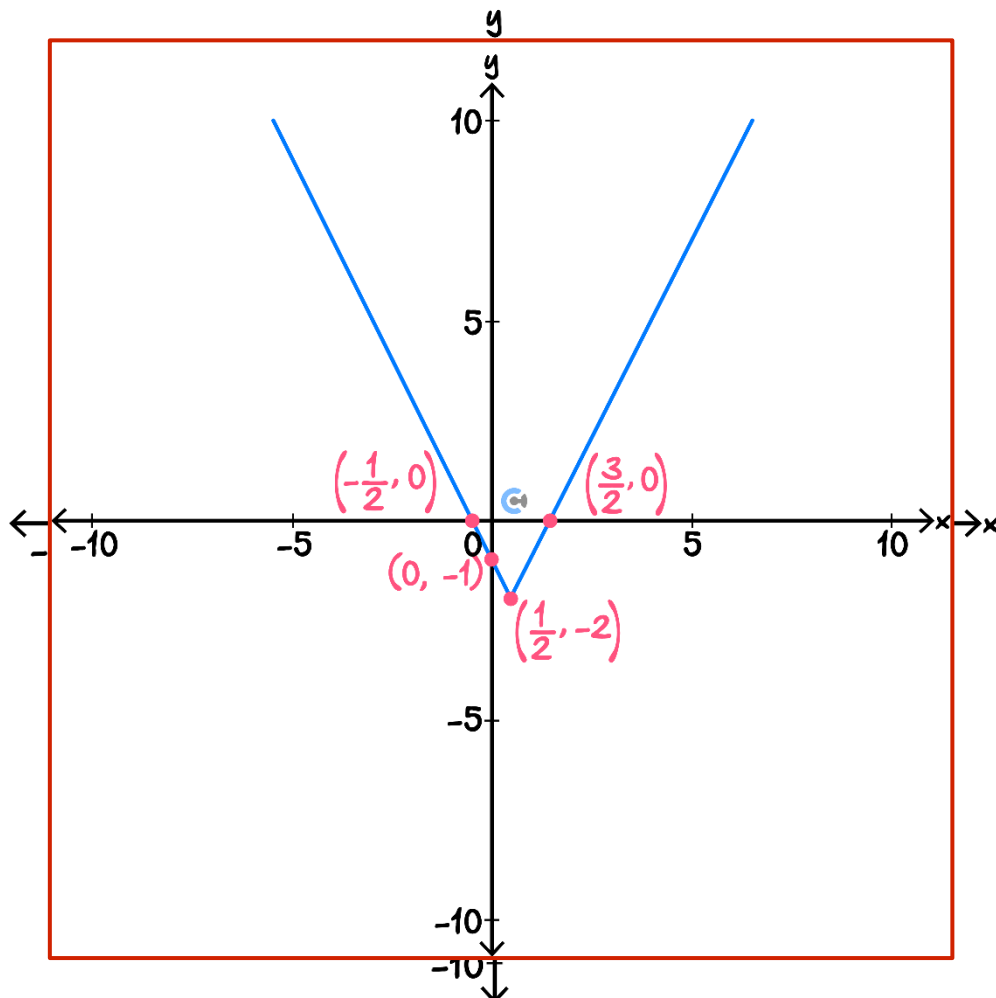
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**Question 2** (4 marks)

You are given that:

$$f(x) = |2x - 1| - 2$$

- a. Sketch the graph of  $f(x)$  on the set of axes below, clearly indicating the coordinates of any points where the graph of  $f(x)$  meets the coordinate axes. (2 marks)



- b. Using your graph, or otherwise, find the values of  $x$  for which  $f(x) \geq 3$ . (2 marks)

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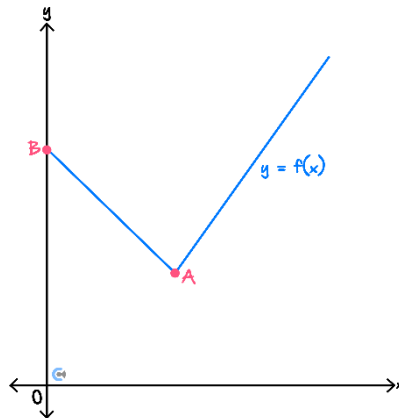
$x \geq 3 \text{ or } x \leq -2$

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Question 3 (6 marks)



The above figure shows a sketch of part of the graph of  $y = f(x)$ , where:

$$f(x) = a|h - x| + b$$

- a. You are given that the coordinates of  $A$  are  $(3,5)$  and the coordinates of  $B$  are  $(0,11)$ . Find the values of  $a$ ,  $h$  and  $b$ . (2 marks)

$$a = 2, h = 3, b = 5$$

- b. Solve the equation  $f(x) = \frac{1}{2}x + 30$  for  $x$ . (3 marks)

$$x = -\frac{38}{5} \text{ or } x = \frac{62}{3}$$

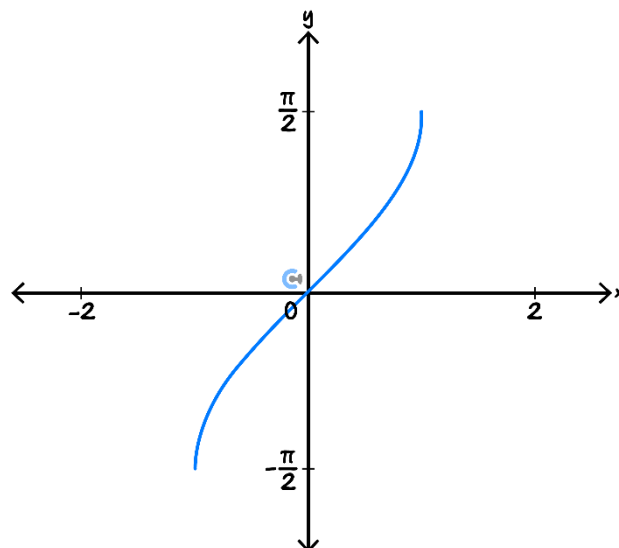
Given that the equation  $f(x) = k$ , where  $k$  is a constant, has two distinct roots.

c. State the set of possible values for  $k$ . (1 mark)

$$k \geq 5$$

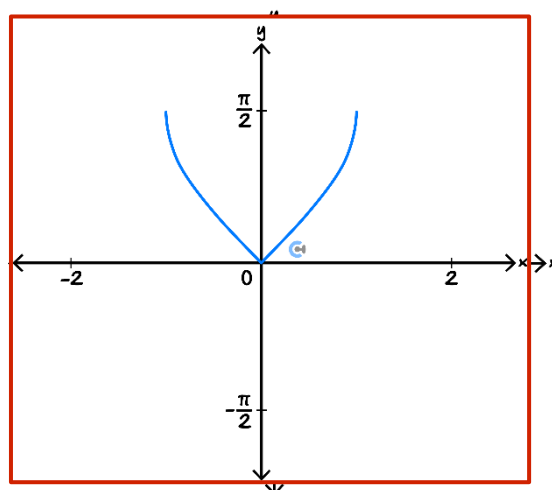
**Question 4** (4 marks)

The graph of  $y = f(x)$  is shown on the set of axes below:

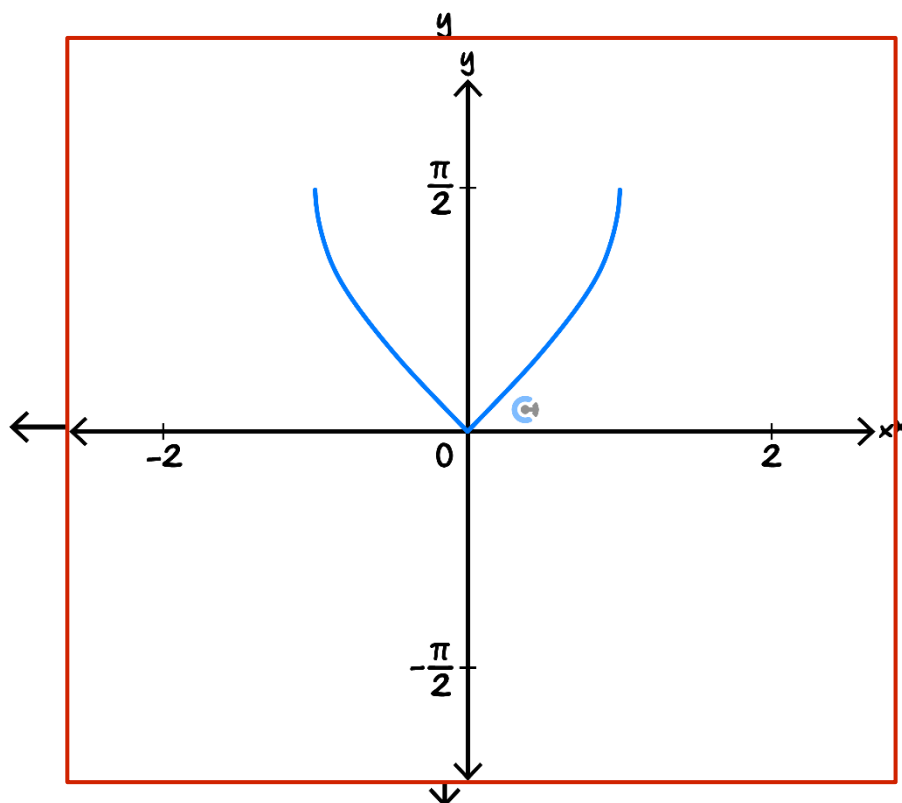


On the set of axes below, sketch the graphs of:

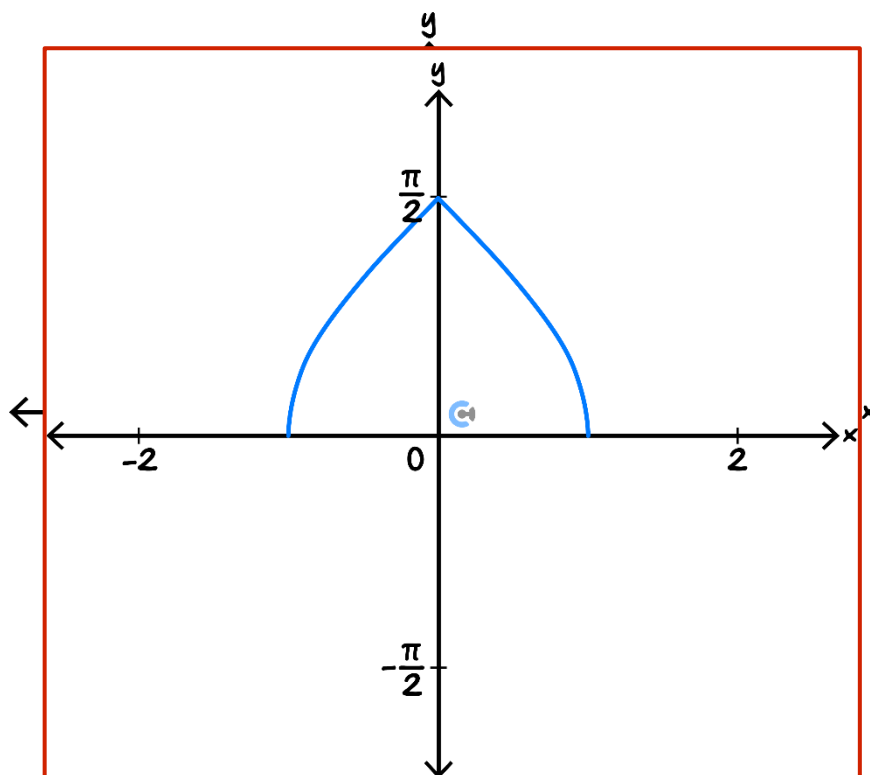
a.  $y = |f(x)|$ . (1 mark)



b.  $y = f(|x|)$ . (1 mark)



c.  $y = f(-|x|) + \frac{\pi}{2}$ . (2 marks)



**Question 5** (3 marks)

Solve the following inequality for  $x$ :

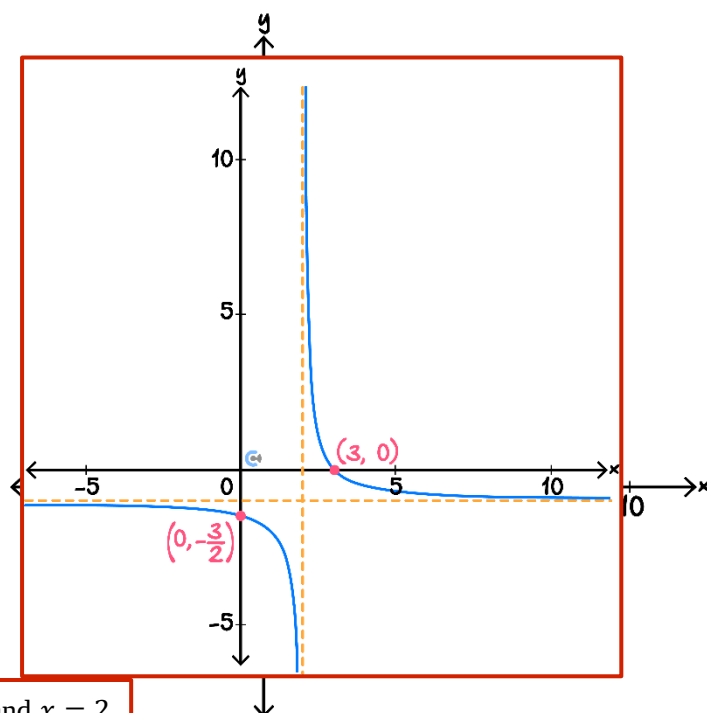
$$|2x - 1| - 1 < |x - 1|$$

$$x \in (-1, 1) \text{ or } -1 < x < 1$$

**Question 6** (8 marks)

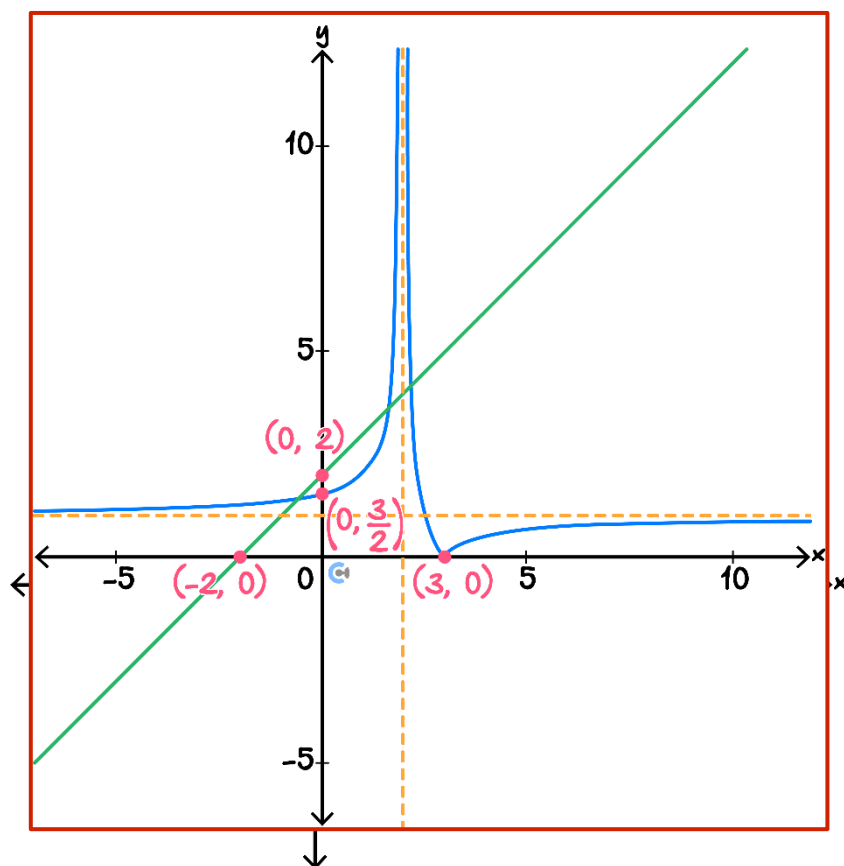
Consider the function  $f : \mathbb{R} \setminus \{2\} \rightarrow \mathbb{R}, f(x) = \frac{1}{x-2} - 1$ .

- a. Sketch the graph of  $y = f(x)$  on the set of axes below, labelling all asymptotes and axial intercepts. (2 marks)



Asymptote at  $y = 1$  and  $x = 2$

- b. Hence, on the set of axes below, sketch the graph of  $y = |f(x)|$ , labelling all asymptotes and axial intercepts. (2 marks)



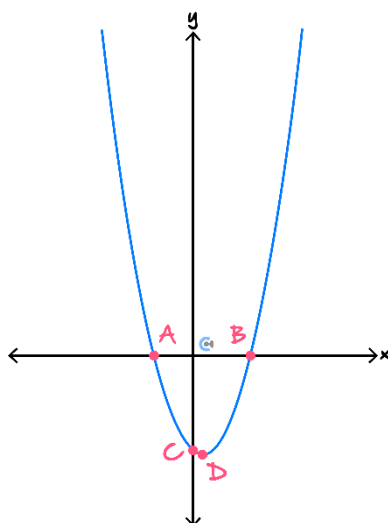
- c. On the same set of axes above in **part b.**, sketch the line  $y = x + 2$ , labelling the axial intercepts. (1 mark)

- d. Hence, solve the inequality  $|f(x)| \leq x + 2$ . (3 marks)

$$\frac{-(\sqrt{5} - 1)}{2} \leq x \leq \frac{\sqrt{5} + 1}{2} \text{ or } x \geq \frac{\sqrt{29} - 1}{2}$$

**Question 7** (9 marks)

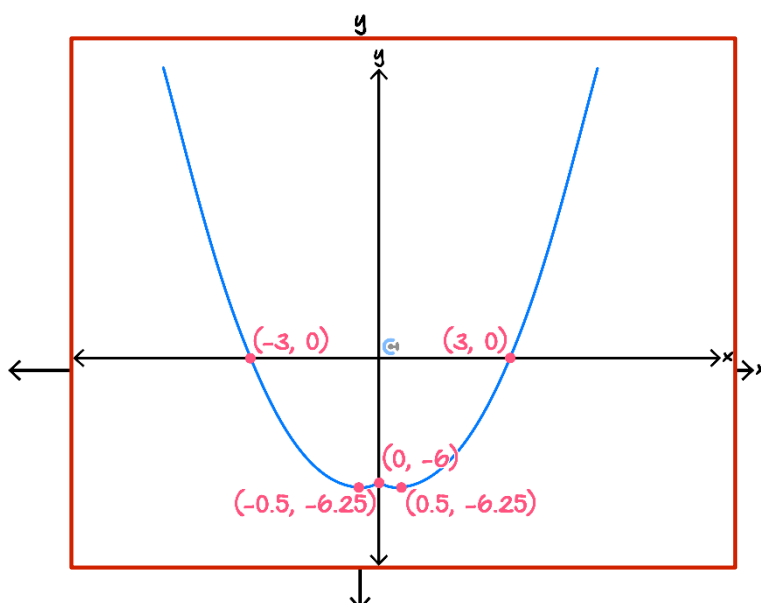
The graph of  $y = g(x)$ , where  $g(x) = x^2 - x - 6$  is shown below:



- a. Write down the coordinates of  $A, B, C$  and  $D$ . (2 marks)

|                                                     |                                                     |
|-----------------------------------------------------|-----------------------------------------------------|
| $(-2, 0)$                                           | $(0, -6)$                                           |
| <input checked="" type="checkbox"/> Label: <u>A</u> | <input checked="" type="checkbox"/> Label: <u>C</u> |
| $(3, 0)$                                            | $\left(\frac{1}{2}, -\frac{25}{4}\right)$           |
| <input checked="" type="checkbox"/> Label: <u>B</u> | <input checked="" type="checkbox"/> Label: <u>D</u> |

- b. On the set of axes below, sketch the graph of  $y = g(|x|)$ , labelling all turning points and axial intercepts. (3 marks)



c. Find all the values of  $k$  for which the equation  $g(|x|) + k = 0$  has:

i. Three distinct solutions. (1 mark)

$$k = 6$$

ii. Four distinct solutions. (1 mark)

$$6 < k < \frac{25}{4}$$

iii. Two distinct solutions. (2 marks)

$$k < 6 \text{ or } k = \frac{25}{4}$$

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