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VCE Mathematical Methods ½
Functions & Relations I [2.1]
Test

37 Marks. 39 Minutes Writing.

Results:

Test Questions	_____ / 29
Extension Test Questions	_____ / 8

Section A: Test Questions (29 Marks)

Question 1 (5 marks)

Tick whether the following statements are **true** or **false**.

Statement	True	False
a. Positive hyperbolas generally take up the 1^{st} and 3^{rd} quadrants.		
b. To find the equation of a hyperbola, you can use three points that it passes through.		
c. Truncus can be both above and below the asymptote at the same time.		
d. All points on the circle can have different distances from the centre.		
e. The graph of $y = -\sqrt{2-x} + 1$ starts from $(2,1)$ and continues infinitely into the quadrant 4.		
f. Root functions get steeper as it travels towards positive or negative infinity.		
g. Left and right semicircles are given by making the x value the subject from the circle.		
h. $y = \pm\sqrt{r^2 - (x-h)^2} + k$ is an equation of a semicircle.		
i. Circles do not pass a vertical line test and a horizontal line test.		
j. All functions are relations, but not all relations are functions.		

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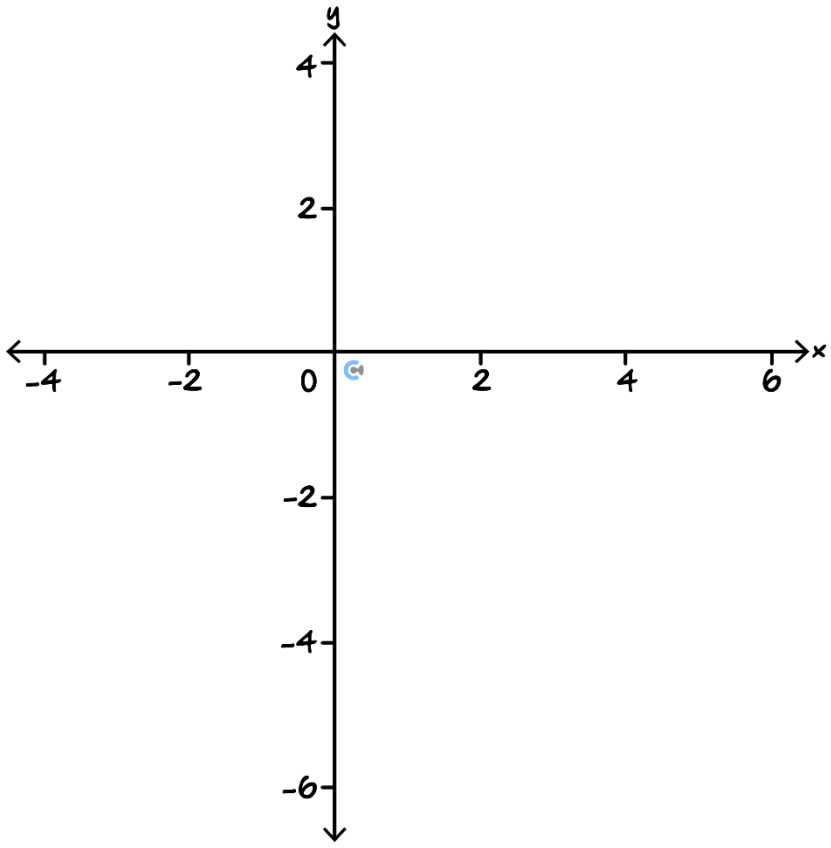
Question 2 (5 marks)

Let $f: D \to R, f(x) = \frac{x-4}{x-2}$.

a. Express f in the form $a + \frac{b}{x-2}$, stating the values of a and b. (1 mark)

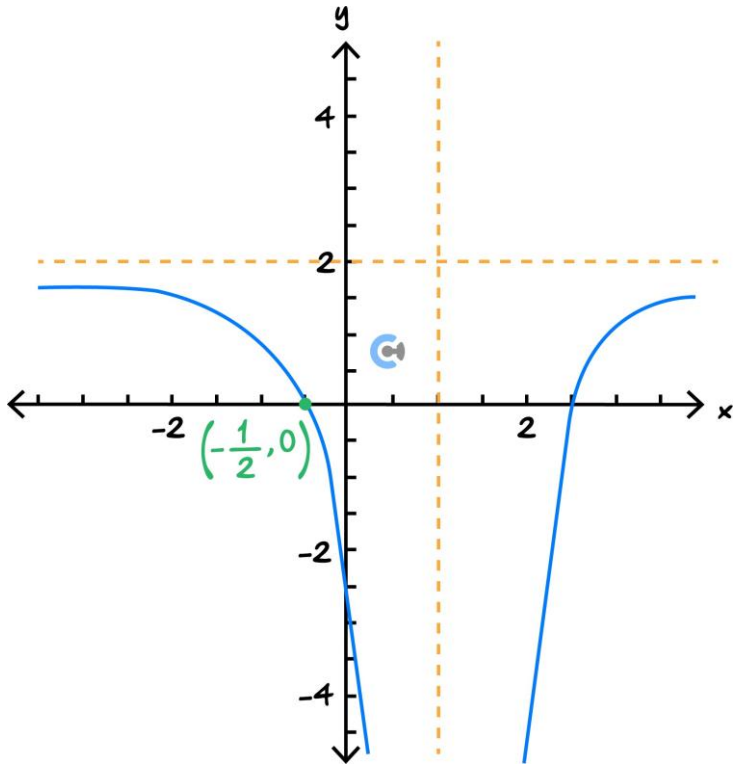
b. Sketch the graph of $y = 1 - \frac{2}{x-2}$ on the axes below. Label asymptotes with their equations and axis intercepts with their coordinates. (3 marks)



c. Find the values of x for which $1 - \frac{2}{x-2} \geq 3$. (1 mark)

Question 3 (3 marks)

Part of the graph of the function with the equation $y = \frac{a}{(x+b)^2} + c$ is shown below. Find the values of a, b, c. Show your working.



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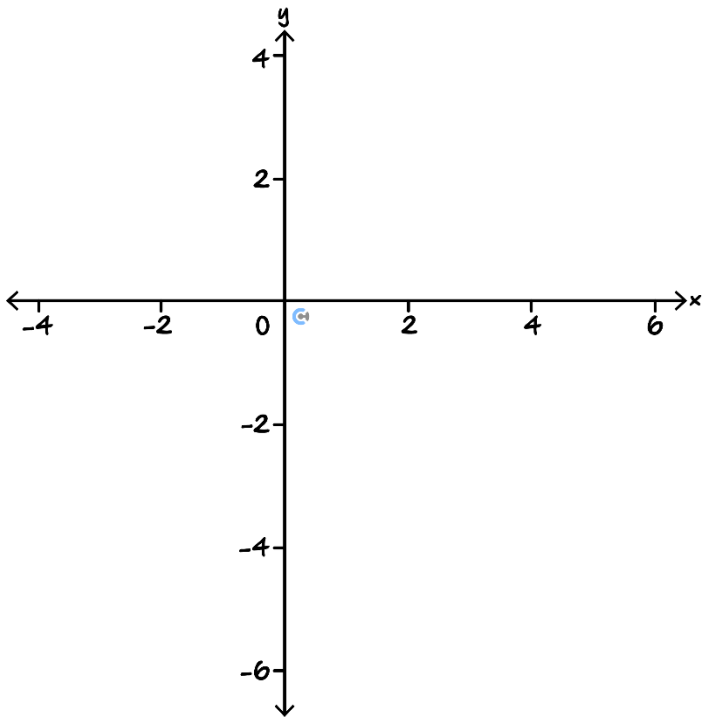
Question 4 (6 marks)

The function defined by $y = a\sqrt{x-h}+k$, where a, h and k are non-zero integers, has a y-intercept at $\left(0, 2\sqrt{3}-3\right)$ and has an endpoint at $(-3,-3)$.

a. Determine the values of a, h and k. (2 marks)

b. Find the coordinates of the x-intercept. (2 marks)

c. Sketch the graph of the function on the axis below, labelling all key features. (2 marks)

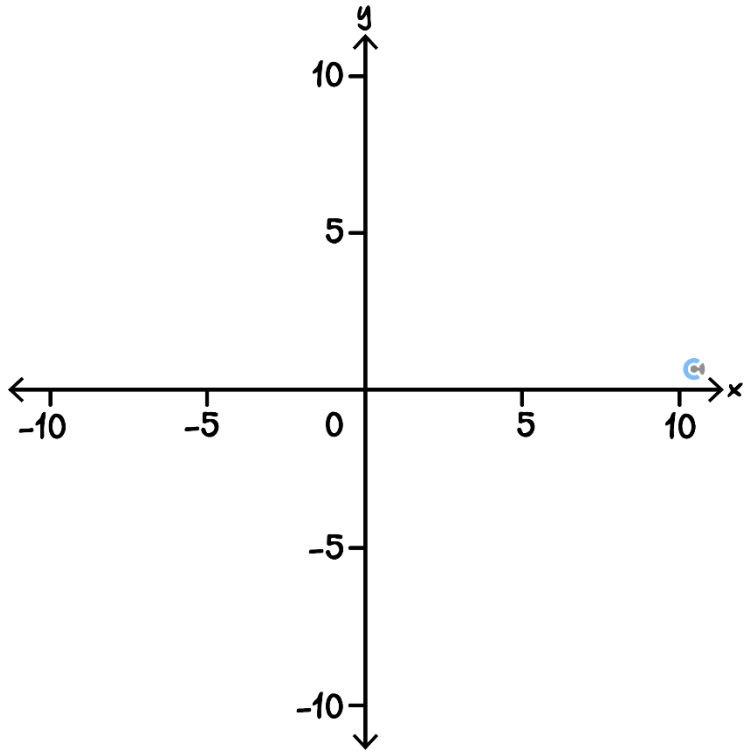


Question 5 (7 marks)

For the relation defined by $(x+3)^2+(y-4)^2=25$.

a. Find the radius and centre of the equation. (1 mark)

b. Graph the relation, labelling all the coordinates of the axial intercepts. (3 marks)



c. State the domain and the range of the relation. (1 mark)

d. Find the equation of the semicircle derived from this relation, given that it passes through $(-3, -1)$ and is considered to be a function. (2 marks)

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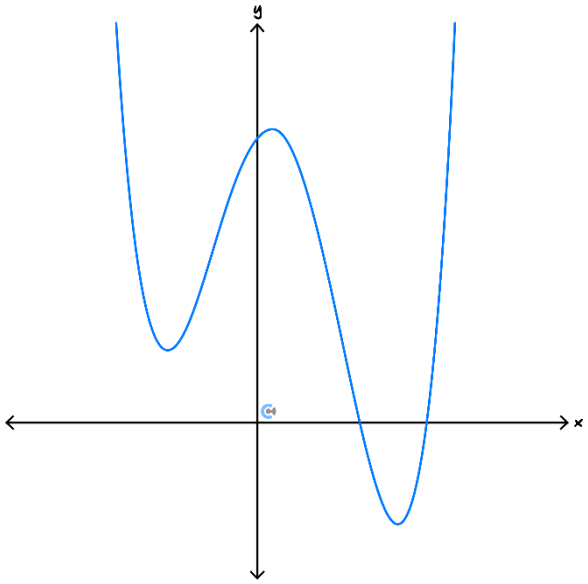
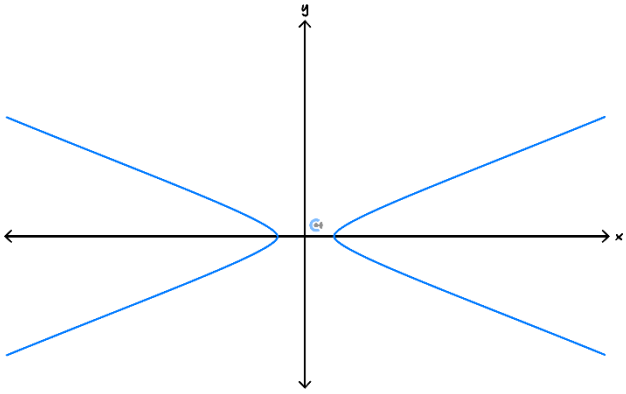
Question 6 (1 mark)

Label the following graphs as being either a function or a relation.





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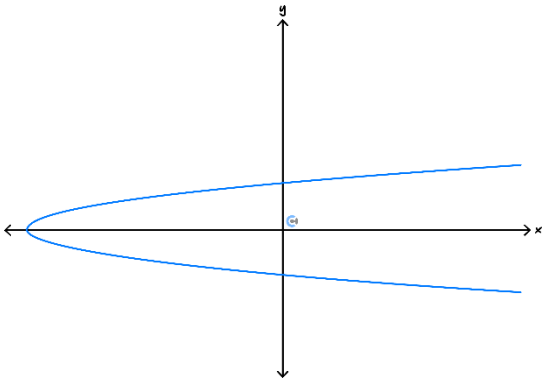
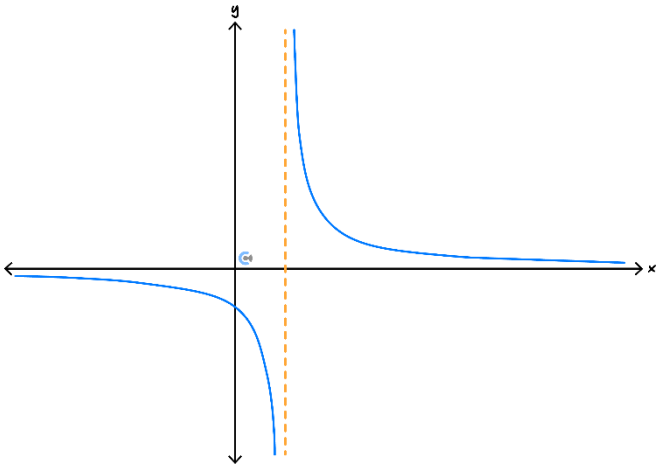
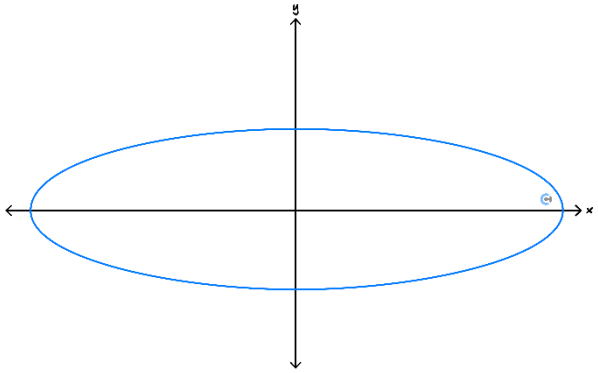
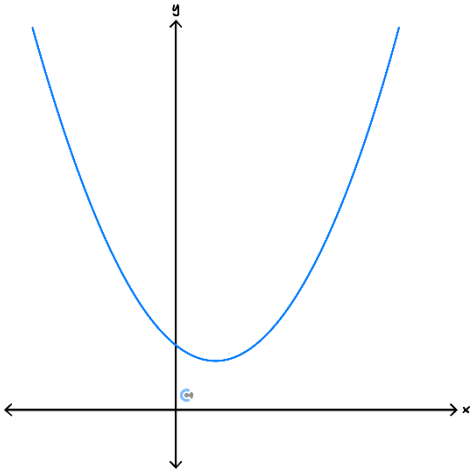
Question 7 (2 marks)

Label the following graphs as being either: one to one, one to many, many to one or many to many.









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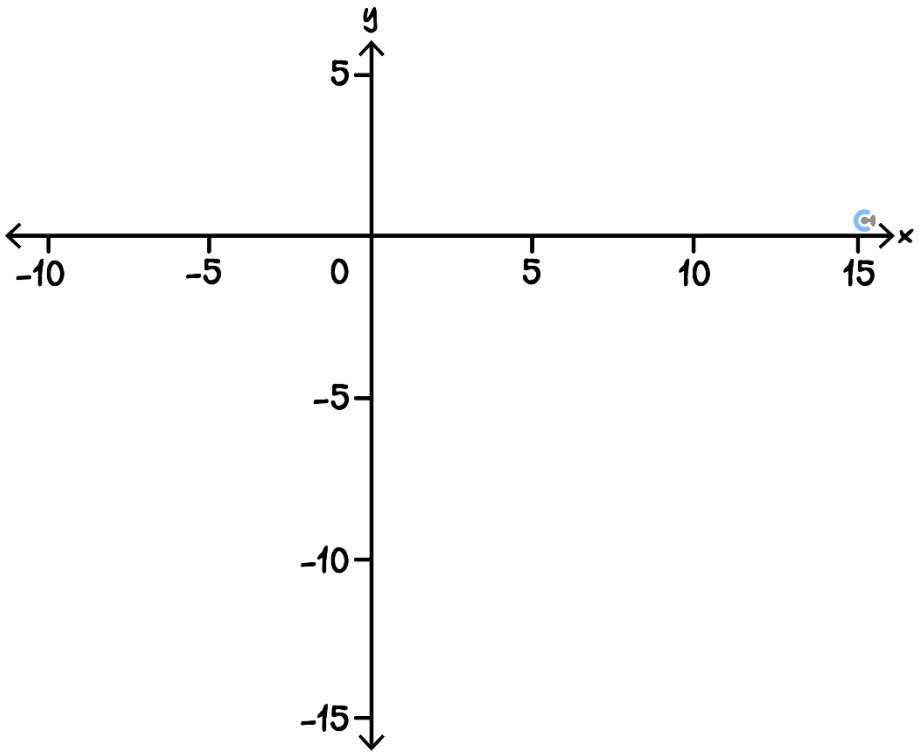
Section B: Extension Test Questions (8 Marks)

Question 8 (8 marks) **Tech-Active.**

The cross-section of a water cleft is modelled with the equation $h = -\frac{12}{(x-5)^2} + 2, 0 \leq x \leq 10$ where h is the height in metres above the water's surface, and x is the horizontal distance from the warning sign (origin).

a. Find the x-intercept of the function and, hence, find the width of the cleft at the water surface. (2 marks)

b. Sketch the graph of $h = \frac{-12}{(x-5)^2} + 2$ for $0 \leq x \leq 10$, labelling all axial intercepts and endpoints. (2 marks)



c. What's the width of the cleft at 0.5 metres above the water surface? (2 marks)

It is known that at a metres below the water surface, the width of the cleft is given by 3 m.

d. Find the value of a. (2 marks)

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