5.9 Drawing Quadratic Graphs: 1-hour Pack

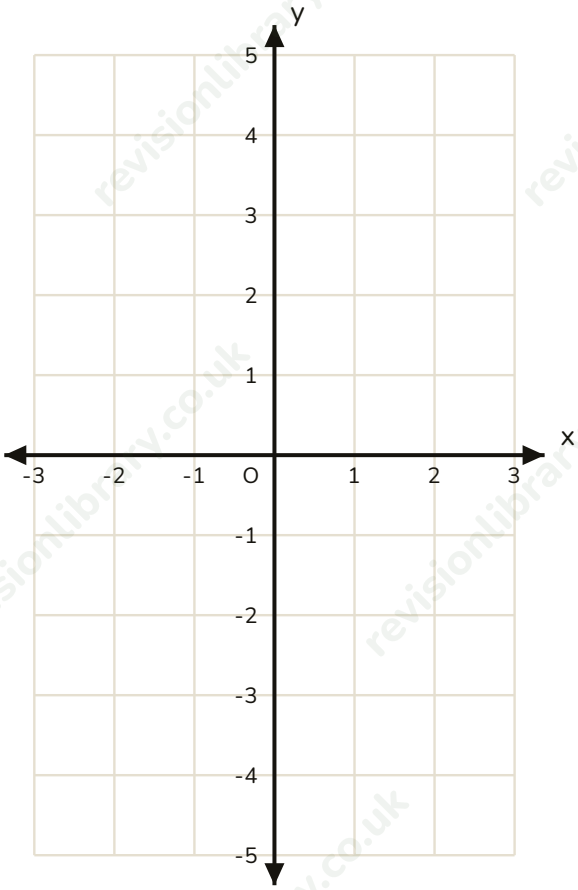
EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The graph of $y = 4 - x^2$ is to be drawn for $-3 \leq x \leq 3$.

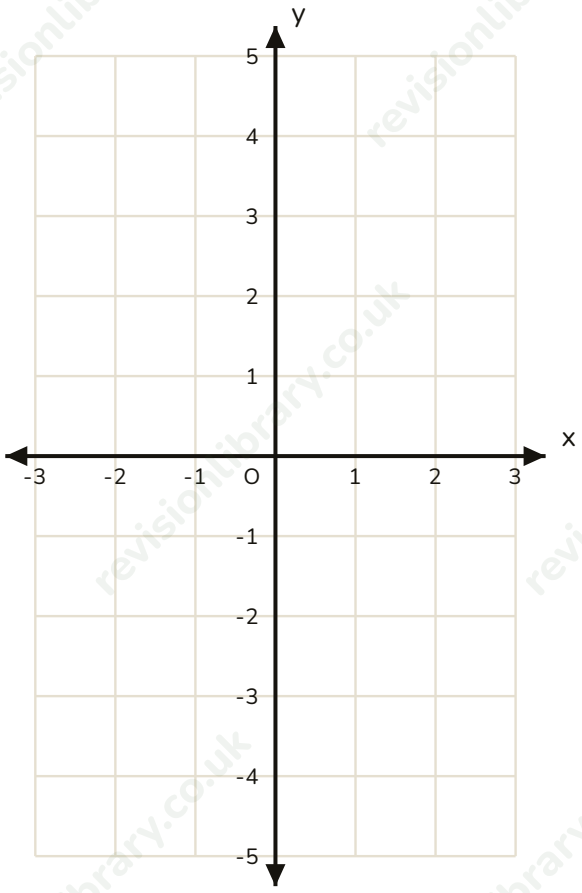


(a) Complete the table of values for $y = 4 - x^2$. **(2)**

x	-3	-2	-1	0	1	2	3
y	_	_	_	_	_	_	_

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(b) Draw the graph of $y = 4 - x^2$ for $-3 \leq x \leq 3$. **(2)**



(c) Write down the coordinates of the points where the curve crosses the x-axis. **(2)**

.....

(d) Write down the coordinates of the turning point of the graph. **(1)**

.....

(Total for Question 1 is 7 marks)

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2 For each equation, state whether its graph is u-shaped or n-shaped.

(i) $y = x^2 - 5$ **(1)**

(ii) $y = 7 - 2x^2$ **(1)**

(iii) $y = 3x^2 + x - 1$ **(1)**

(iv) $y = 1 - x - x^2$ **(1)**

(Total for Question 2 is 4 marks)

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3 The graph of $y = 2x^2$ is narrower than $y = x^2$.

(a) Explain in one sentence why $y = 2x^2$ is narrower than $y = x^2$. **(1)**

(b) Find y when x = 1. **(2)**

(c) Find y when x = 2. **(2)**

(Total for Question 3 is 5 marks)

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4 A student is given the graph of $y = x^2$ and is asked to draw the graph of $y = (x + 2)^2$. Describe how to transform the graph and give the vertex of the new graph.

(a) Describe the transformation from $y = x^2$ to $y = (x + 2)^2$. **(2)**

(b) Give the vertex (turning point) of $y = (x + 2)^2$. **(4)**

(Total for Question 4 is 6 marks)

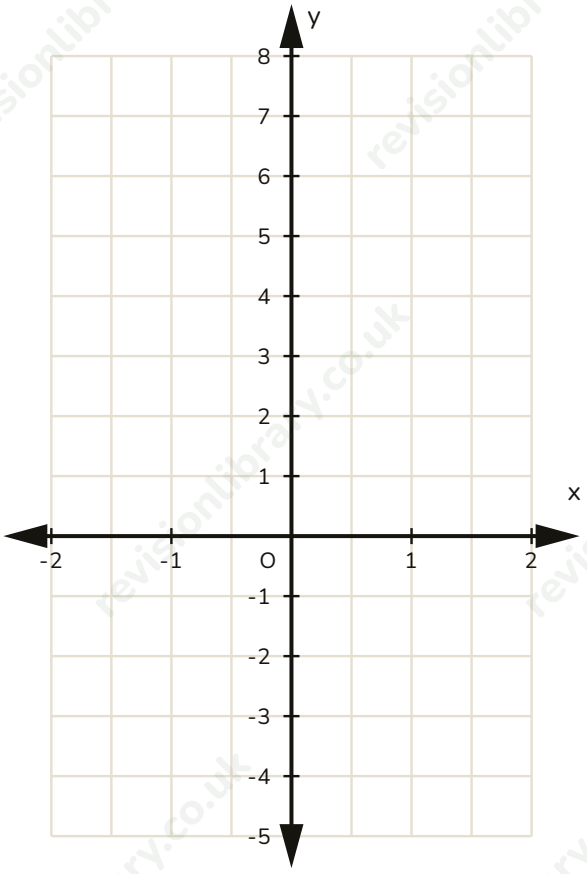
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5 State the range of the quadratic $y = -(x - 3)^2 + 7$. Justify your answer in one sentence.

(Total for Question 5 is 2 marks)

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6 The graph of $y = 3x^2 - 5$ is to be drawn for $-2 \leq x \leq 2$.

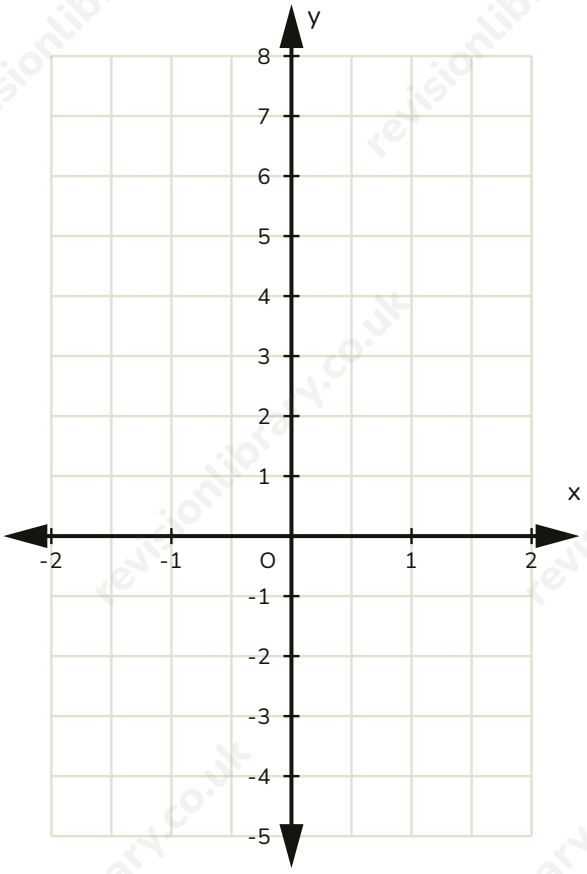


(a) Complete the table of values for $y = 3x^2 - 5$. **(2)**

x	-2	-1	-0.5	0	0.5	1	2
y	7	-2	_	-5	_	-2	7

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(b) Draw the graph of $y = 3x^2 - 5$ for $-2 \leq x \leq 2$. **(2)**



(c) Use your graph to find estimates for the solutions of $3x^2 - 5 = 0$. **(2)**

(Total for Question 6 is 6 marks)

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7 The graph of $y = x^2 + 3x + 5$ is a u-shaped curve that lies entirely above the x-axis; it does not cross or touch the x-axis at any point.

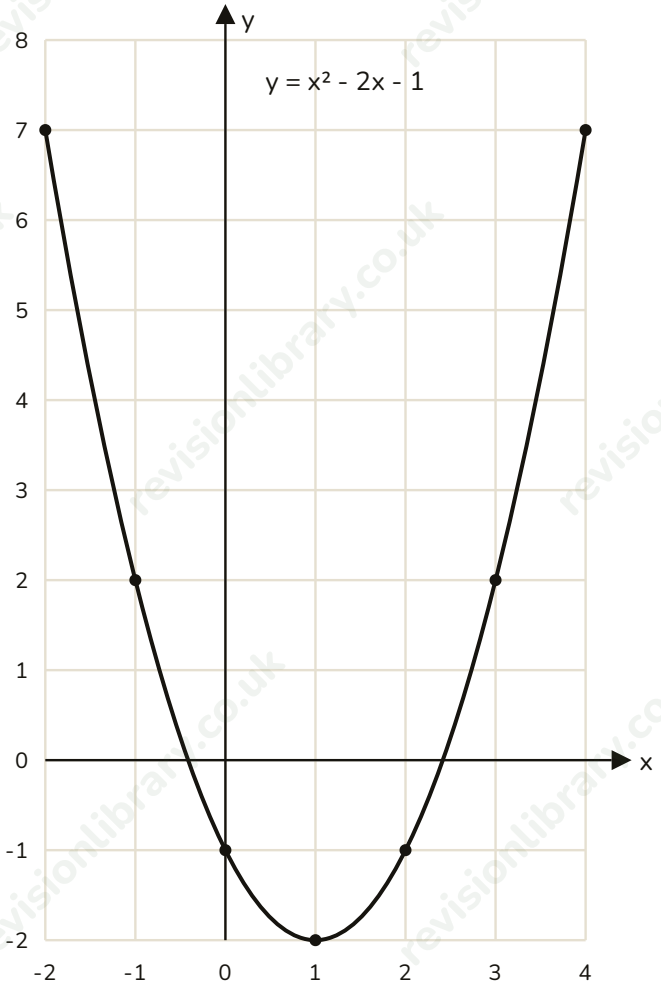
(a) Explain what this tells you about the solutions of the equation $x^2 + 3x + 5 = 0$. **(2)**

(b) State the minimum possible number of times a different u-shaped quadratic graph could cross the x-axis, and the maximum possible number. **(2)**

(Total for Question 7 is 4 marks)

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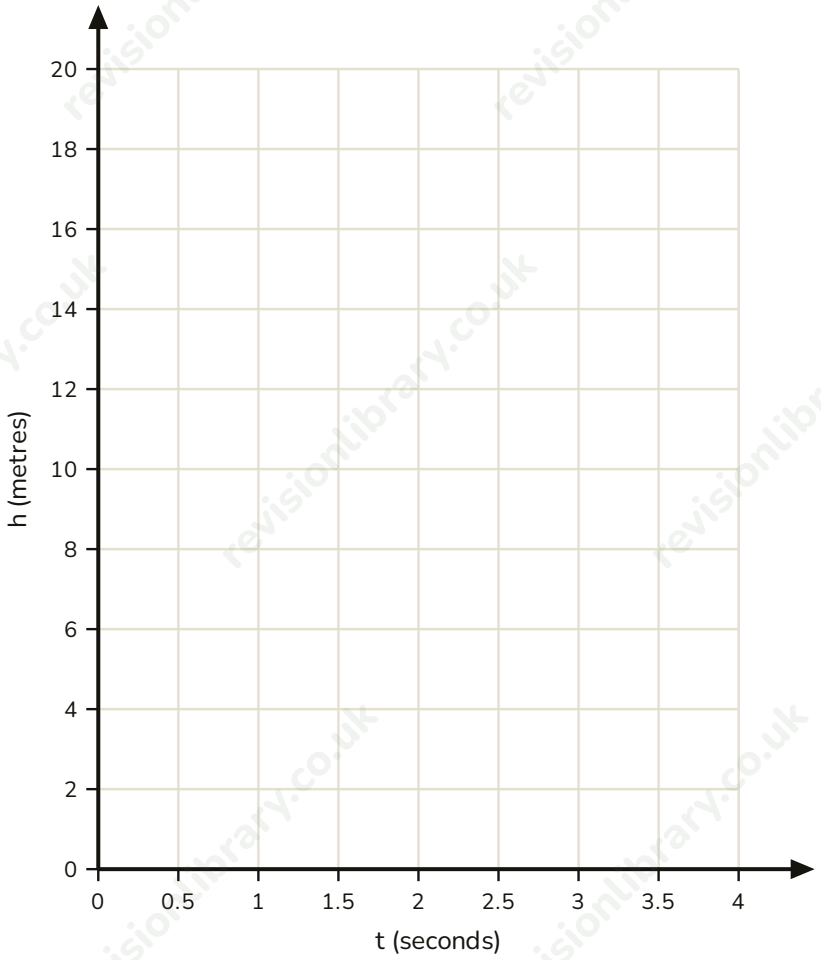
8 The grid shows an accurately drawn graph of $y = x^2 - 2x - 1$ for $-2 \leq x \leq 4$. By drawing a suitable straight line on the grid, use the graph to find estimates for the solutions of $x^2 - 2x - 1 = x - 1$.



(Total for Question 8 is 3 marks)

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9 A ball is thrown in the air. Its height, h metres, above the ground after t seconds is given by $h = 20t - 5t^2$.

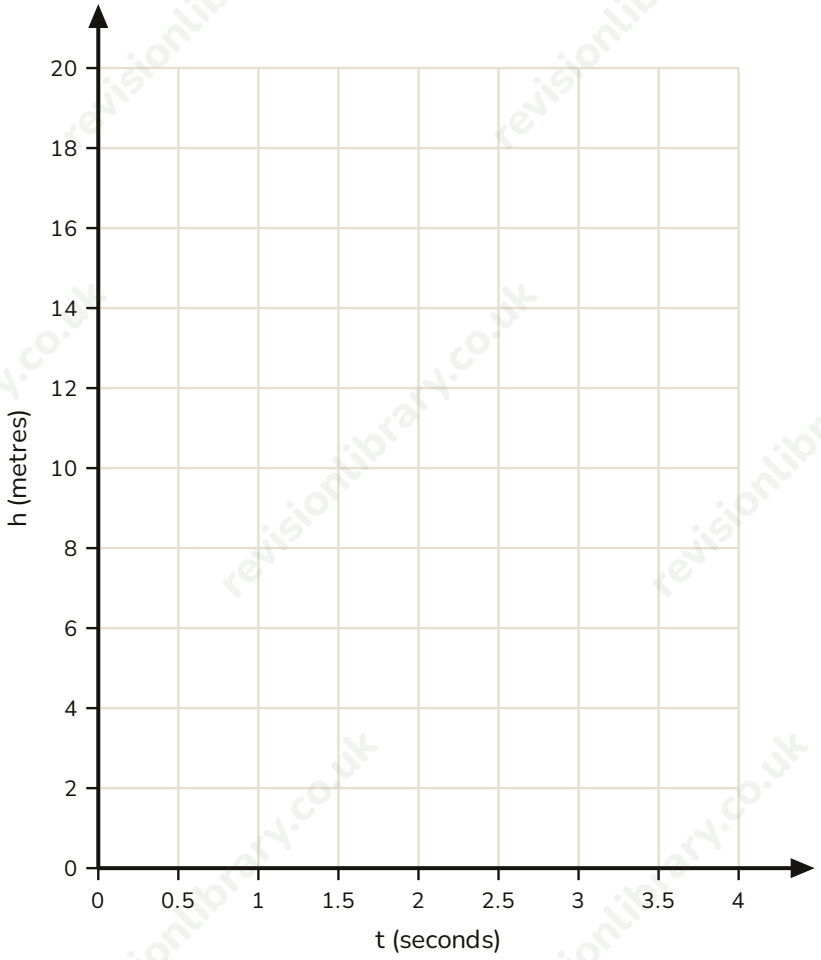


(a) Complete the table of values for $h = 20t - 5t^2$. **(3)**

t	0	0.5	1	1.5	2	2.5	3	3.5	4
h	0	8.75	15	_	20	_	15	_	0

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(b) Draw the graph of $h = 20t - 5t^2$ for $0 \leq t \leq 4$. **(2)**



(c) Use the graph to find the maximum height reached by the ball. **(1)**

(d) Use the graph to estimate the times at which the ball is at a height of 12 metres. **(2)**

(Total for Question 9 is 8 marks)

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Mark scheme · 5.9 Drawing Quadratic Graphs: 1-hour Pack

Question 1

(a) at least 5 of the 7 y-values correct **B1**

(a) all 7 y-values correct **B1**

(a) Answer: -5, 0, 3, 4, 3, 0, -5

(b) all points plotted correctly ft from table **B1**

(b) smooth n-shaped curve drawn through all points **B1**

(b) Answer: Smooth n-shaped parabola, maximum point at (0,4)

(c) (-2, 0) **B1**

(c) (2, 0) **B1**

(c) Answer: (-2, 0) and (2, 0)

(d) (0, 4) **B1**

(d) Answer: (0, 4)

Question 2

(i) u-shaped **B1**

(i) Answer: u-shaped

(ii) n-shaped **B1**

(ii) Answer: n-shaped

(iii) u-shaped **B1**

(iii) Answer: u-shaped

(iv) n-shaped **B1**

(iv) Answer: n-shaped

Question 3

(a) because the coefficient 2 makes y grow faster for a given x oe **B1**

(a) Answer: Because the factor 2 multiplies x^2 so y increases faster for each x, making the parabola steeper.

(b) substitute x = 1 into $2x^2$ **M1**

(b) y = 2 cao **A1**

(b) Answer: 2 [$2(1)^2 = 2$]

(c) substitute x = 2 into $2x^2$ **M1**

(c) y = 8 cao **A1**

(c) Answer: 8 [$2(2)^2 = 2*4 = 8$]

Question 4

(a) state shift left or right with sign identified **M1**

(a) shift left 2 oe **A1**

(a) Answer: The graph is shifted 2 units to the left.

(b) identify h = -2 and k = 0 or state (-2,0) **M1**

(b) vertex (-2, 0) cao **A1**

(b) brief reason: because $(x + 2)^2$ has minimum at x = -2 **A1**

(b) correct coordinates and reason given **A1**

(b) Answer: (-2, 0)

Question 5

state range $y \leq 7$ or (-infinity, 7] oe **B1**

reason: vertex at (3, 7) is a maximum since coefficient is negative oe **B1**

Answer: Range: $y \leq 7$ because the vertex (3, 7) is a maximum (leading coefficient negative).

Question 6

(a) y = -4.25 at x = -0.5 **B1**

(a) y = -4.25 at x = 0.5 **B1**

(a) Answer: -4.25 and -4.25

(b) all 7 points plotted correctly ft from table **B1**

(b) smooth u-shaped curve drawn through all points **B1**

(b) Answer: Smooth u-shaped curve, minimum point at (0,-5)

(c) x = awrt 1.3 (range 1.2 to 1.4), ft **B1**

(c) x = awrt -1.3 (range -1.4 to -1.2), ft **B1**

(c) Answer: x = awrt 1.3 and x = awrt -1.3

Question 7

(a) there are no real solutions/roots **B1**

(a) correct reason: the curve never crosses (or touches) the x-axis oe **B1**

(a) Answer: There are no real solutions, because the curve never crosses (or touches) the x-axis

(b) minimum = 0 **B1**

(b) maximum = 2 **B1**

(b) Answer: Minimum 0, maximum 2

Question 8

line y = x - 1 identified and drawn on the grid **M1**

x = 0 (or awrt 0), ft **A1**

x = 3 (or awrt 3), ft **A1**

Answer: x = 0 and x = 3

Question 9

(a) h = 18.75 at t = 1.5 **B1**

(a) h = 18.75 at t = 2.5 **B1**

(a) h = 8.75 at t = 3.5 **B1**

(a) Answer: t=1.5: 18.75, t=2.5: 18.75, t=3.5: 8.75

(b) all 9 points plotted correctly ft from table **B1**

(b) smooth n-shaped curve drawn through all points **B1**

(b) Answer: Smooth n-shaped curve, maximum point at (2, 20)

(c) 20 metres, ft from candidate's graph **B1**

(c) Answer: 20 metres (at t = 2 seconds)

(d) t = awrt 0.7 (range 0.6 to 0.8), ft from candidate's graph **B1**

(d) t = awrt 3.3 (range 3.2 to 3.4), ft from candidate's graph **B1**

(d) Answer: t = awrt 0.7 seconds and t = awrt 3.3 seconds

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