C18

Graphs of functions

CHAPTER ASSIGNMENT · 366 MARKS

Name _____ Class _____ No. _____ Date _____

Answer every question in the space given. Draw graphs on graph paper with a sharp pencil and attach them. Show your method clearly when you solve an equation with a graph. Where a book figure is needed it is described in words.

Practice questions from *Cambridge IGCSE Mathematics Core and Extended* (4th edition), Chapter 18 (Graphs of functions), for classroom use. Where a book question shows a graph, the graph is described in words because the PDF format cannot carry it; see the book for the figure. The Check yourself and Chapter quiz questions are Guru Jazzy's own.

Exercise 18.1 · Plotting quadratic graphs

18.1.1 For the quadratic function $y = x^2 + x - 2$, $-4 \le x \le 3$ construct a table of values and then draw the graph.

18.1.2 For the quadratic function $y = -x^2 + 2x + 3$, $-3 \le x \le 5$ construct a table of values and then draw the graph.

18.1.3 For the quadratic function $y = x^2 - 4x + 4$, $-1 \le x \le 5$ construct a table of values and then draw the graph.

18.1.4 For the quadratic function $y = -x^2 - 2x - 1$, $-4 \le x \le 2$ construct a table of values and then draw the graph.

18.1.5 For the quadratic function $y = x^2 - 2x - 15$, $-4 \leq x \leq 6$ construct a table of values and then draw the graph.

18.1.6 For the quadratic function $y = 2x^2 - 2x - 3$, $-2 \leq x \leq 3$ construct a table of values and then draw the graph.

18.1.7 For the quadratic function $y = -2x^2 + x + 6$, $-3 \leq x \leq 3$ construct a table of values and then draw the graph.

18.1.8 For the quadratic function $y = 3x^2 - 3x - 6$, $-2 \leq x \leq 3$ construct a table of values and then draw the graph.

18.1.9 For the quadratic function $y = 4x^2 - 7x - 4$, $-1 \leq x \leq 3$ construct a table of values and then draw the graph.

18.1.10 For the quadratic function $y = -4x^2 + 4x - 1$, $-2 \leq x \leq 3$ construct a table of values and then draw the graph.

Exercise 18.2 · Solving quadratic equations by a graph

18.2.1 Solve the quadratic equation $x^2 - x - 6 = 0$, $-4 \leq x \leq 4$ by plotting a graph for the range of x stated.

18.2.2 Solve the quadratic equation $-x^2 + 1 = 0$, $-4 \leq x \leq 4$ by plotting a graph for the range of x stated.

18.2.3 Solve the quadratic equation $x^2 - 6x + 9 = 0$, $0 \leq x \leq 6$ by plotting a graph for the range of x stated.

18.2.4 Solve the quadratic equation $-x^2 - 6x + 12 = 0$, $-5 \leq x \leq 4$ by plotting a graph for the range of x stated.

18.2.5 Solve the quadratic equation $x^2 - 4x + 4 = 0$, $-2 \le x \le 6$ by plotting a graph for the range of x stated.

18.2.6 Solve the quadratic equation $2x^2 - 7x + 3 = 0$, $-1 \le x \le 5$ by plotting a graph for the range of x stated.

18.2.7 Solve the quadratic equation $-2x^2 + 4x - 2 = 0$, $-2 \le x \le 4$ by plotting a graph for the range of x stated.

18.2.8 Solve the quadratic equation $3x^2 - 5x - 2 = 0$, $-1 \le x \le 3$ by plotting a graph for the range of x stated.

Exercise 18.3 · Solving other quadratic equations by a graph

18.3.1 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $x^2 - x - 4 = 0$. Show your method clearly.

18.3.2 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $-x^2 - 1 = 0$. Show your method clearly.

18.3.3 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $x^2 - 6x + 8 = 0$. Show your method clearly.

18.3.4 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $-x^2 - x + 9 = 0$. Show your method clearly.

18.3.5 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $x^2 - 4x + 1 = 0$. Show your method clearly.

18.3.6 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $2x^2 - 7x = 0$. Show your method clearly.

18.3.7 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $-2x^2 + 4x = -1$. Show your method clearly.

18.3.8 Using the graphs that you drew in Exercise 18.2, solve the quadratic equation $3x^2 = 2 + 5x$. Show your method clearly.

Exercise 18.4 · Completed square form and turning points

18.4.1 For the quadratic $y = (x - 1)^2 + 4$; $-2 \leq x \leq 4$:

(a) Plot a graph of the function for the values of x given. [3]

(b) State whether the turning point is a maximum or a minimum point. [1]

(c) Write down the coordinates of the turning point. [1]

18.4.2 For the quadratic $y = (x + 3)^2 - 6$; $-6 \leq x \leq 0$:

(a) Plot a graph of the function for the values of x given. [3]

(b) State whether the turning point is a maximum or a minimum point. [1]

(c) Write down the coordinates of the turning point. [1]

18.4.3 For the quadratic $y = (x - 4)^2 - 1$; $0 \leq x \leq 7$:

(a) Plot a graph of the function for the values of x given. **[3]**

(b) State whether the turning point is a maximum or a minimum point. **[1]**

(c) Write down the coordinates of the turning point. **[1]**

18.4.4 For the quadratic $y = -(x - 2)^2 + 3$; $-1 \leq x \leq 5$:

(a) Plot a graph of the function for the values of x given. **[3]**

(b) State whether the turning point is a maximum or a minimum point. **[1]**

(c) Write down the coordinates of the turning point. **[1]**

18.4.5 For the quadratic $y = -(x + 1)^2 - 5$; $-4 \leq x \leq 3$:

(a) Plot a graph of the function for the values of x given. **[3]**

(b) State whether the turning point is a maximum or a minimum point. **[1]**

(c) Write down the coordinates of the turning point. [1]

18.4.6 For the quadratic $y = 2(x - 1)^2 - 3$; $-3 \leq x \leq 5$:

(a) Plot a graph of the function for the values of x given. [3]

(b) State whether the turning point is a maximum or a minimum point. [1]

(c) Write down the coordinates of the turning point. [1]

18.4.7 For the quadratic $y = 3(x - 3)^2 - 20$; $0 \leq x \leq 6$:

(a) Plot a graph of the function for the values of x given. [3]

(b) State whether the turning point is a maximum or a minimum point. [1]

(c) Write down the coordinates of the turning point. [1]

18.4.8 For the quadratic $y = -2(x - 5)^2 + 30$; $2 \leq x \leq 8$:

(a) Plot a graph of the function for the values of x given. [3]

(b) State whether the turning point is a maximum or a minimum point. [1]

(c) Write down the coordinates of the turning point. [1]

18.4.9 For the quadratics in Q.1–8:

(a) Describe any pattern you spot between the coordinates of the turning point and the equation of the quadratics in each of the graphs plotted in Q.1–8 above. [2]

(b) If the general equation of a quadratic in completed square form is given as $y = a(x - b)^2 + c$, write down the coordinates of the turning point. [1]

18.4.10 Without plotting the graph, deduce the coordinates of the turning point in each of the following:

(a) $y = (x - 6)^2 + 5$	(b) $y = (x + 8)^2 - 6$	(c) $y = -(x + 4)^2 + 12$	(d) $y = -2(x - 12)^2 + 1$

Exercise 18.5 · The reciprocal function

18.5.1 Plot the graph of the function $y = 1/x$ for $-4 \le x \le 4$.

18.5.2 Plot the graph of the function $y = 3/x$ for $-4 \le x \le 4$.

18.5.3 Plot the graph of the function $y = 5/(2x)$ for $-4 \le x \le 4$.

Exercise 18.6 · Tables of values and graphs

18.6.1 For the function $f(x) = 3x + 2$, $-3 \le x \le 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.2 For the function $f(x) = \frac{1}{2}x + 4$, $-3 \le x \le 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.3 For the function $f(x) = -2x - 3$, $-4 \le x \le 2$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.4 For the function $f(x) = 2x^2 - 1$, $-3 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.5 For the function $f(x) = 0.5x^2 + x - 2$, $-5 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.6 For the function $f(x) = 3x^2 - 2x + 1$, $-2 \leq x \leq 2$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.7 For the function $f(x) = 2x^3$, $-2 \leq x \leq 2$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.8 For the function $f(x) = \frac{1}{2}x^3 - 2x + 3$, $-3 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.9 For the function $f(x) = 3x^{-1}$, $-3 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.10 For the function $f(x) = 2x^{-2}$, $-3 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

18.6.11 For the function $f(x) = 1/x^2 + 3x$, $-3 \leq x \leq 3$:

(i) draw up a table of values for x and f(x), [2]

(ii) plot the graph of the function. [3]

Exercise 18.7 · Exponential functions

18.7.1 For the function $f(x) = 3^x$, $-3 \leq x \leq 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

18.7.2 For the function $f(x) = 1, -3 \leq x \leq 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

18.7.3 For the function $f(x) = 2^x + 3, -3 \leq x \leq 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

18.7.4 For the function $f(x) = 3 \times 2^x + 2, -3 \leq x \leq 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

18.7.5 For the function $f(x) = 2^x - x$, $-3 \le x \le 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

18.7.6 For the function $f(x) = 3^x - x$, $-3 \le x \le 3$:

(i) draw up a table of values of x and f(x), [2]

(ii) plot a graph of the function. [3]

Exercise 18.8 · Gradients of curves

18.8.1 For the function $y = x^2$, $-4 \le x \le 4$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where x = 1. [2]

18.8.2 For the function $y = \frac{1}{2}x^2$, $-4 \leq x \leq 4$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where x = −2. [2]

18.8.3 For the function $y = x^3$, $-3 \leq x \leq 3$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where x = 1. [2]

18.8.4 For the function $y = x^3 - 3x^2$, $-4 \leq x \leq 4$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where $x = -2$. [2]

18.8.5 For the function $y = 4x^{-1}$, $-4 \le x \le 4$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where $x = -1$. [2]

18.8.6 For the function $y = 2^x$, $-3 \le x \le 3$:

(i) plot a graph, [3]

(ii) calculate the gradient of the function at the specified point, where $x = 0$. [2]

Exercise 18.9 · Solving equations by graphical methods

18.9.1 (a) Plot the function $y = \frac{1}{2}x^2 + 1$ for $-4 \le x \le 4$. [3]

(b) Showing your method clearly, use the graph to solve the equation $\frac{1}{2}x^2 = 4$. [2]

18.9.2 (a) Plot the function $y = x^3 + x - 2$ for $-3 \leq x \leq 3$. [3]

(b) Showing your method clearly, use the graph to solve the equation $x^3 = 7 - x$. [2]

18.9.3 (a) Plot the function $y = 2x^3 - x^2 + 3$ for $-2 \leq x \leq 2$. [3]

(b) Showing your method clearly, use the graph to solve the equation $2x^3 - 7 = 0$. [2]

18.9.4 (a) Plot the function $y = 2/x^2 - x$ for $-4 \leq x \leq 4$. [3]

(b) Showing your method clearly, use the graph to solve the equation $4x^3 - 10x^2 + 2 = 0$. [2]

18.9.5 An open box with a volume of 80 cm^3 is made by cutting 5 cm squares from each corner of a square piece of metal and then folding up the sides. (The figure shows the cross-shaped net, with the side of the original square marked x cm and a 5 cm square cut from each corner, and the folded open box 5 cm deep.)

(a) Write an expression for both the length and width of the box in terms of x. [2]

(b) Write an equation for the volume of the box in terms of x. [2]

(c) Calculate the possible dimensions of the original square metal sheet. [3]

18.9.6 The cross section of a bowl is shown on the axes. y represents the bowl's depth and x its horizontal position. (The figure shows a curve starting at the origin, dipping below the x-axis to a lowest point and rising again to the right.) The equation of the surface of the bowl is given as $y = \frac{1}{2}x^2 - 4x - 2$. Calculate the depth of the bowl. [3]

18.9.7 The cuboid has dimensions $(x - 7)$, $(x - 2)$ and $(x - 4)$, as shown in the figure.

(a) Write an equation for the volume V of the cuboid in terms of x. [2]

(b) Sketch a graph of the volume V of the cuboid for values of x in the range $2 \leq x \leq 7$. [3]

(c) Explain, using your graph, why the value of x must lie between 2 cm and 4 cm. [2]

(d) Using trial and improvement, deduce the value of x (to 1 d.p.) which produces the cuboid with the largest volume. [3]

18.9.8 (a) Plot the function $y = 2^x - x$ for $-2 \leq x \leq 5$. [3]

(b) Showing your method clearly, use the graph to solve the equation $2^x = 2x + 2$. [2]

18.9.9 A tap is dripping at a constant rate into a container. The level (l cm) of the water in the container is given by the equation $l = 2^t - 1$, where t is the time taken in hours.

(a) Calculate the level of the water after 3 hours. [1]

(b) Calculate the level of the water in the container at the start. [1]

(c) Calculate the time taken for the level of the water to reach 31 cm. [2]

(d) Plot a graph showing the level of the water over the first 6 hours. [3]

(e) From your graph, estimate the time taken for the water to reach a level of 45 cm. [2]

18.9.10 Draw a graph of $y = 4^x$ for values of x between −1 and 3. Use your graph to find approximate solutions to the following equations:

(a) $4^x = 30$ [2]

(b) $4^x = ½$ [2]

18.9.11 Draw a graph of $y = 2^x$ for values of x between −2 and 5. Use your graph to find approximate solutions to the following equations:

(a) $2^x = 20$ [2]

(b) $2^{(x + 2)} = 40$ [2]

(c) $2^{-x} = 0.2$ [2]

18.9.12 During an experiment, it is found that harmful bacteria grow at an exponential rate with respect to time. The approximate population of the bacteria, P, is modelled by the equation $P = 4^t + 100$, where t is the time in hours.

(a) Calculate the approximate number of harmful bacteria at the start of the experiment. [1]

(b) Calculate the number of harmful bacteria after 5 hours. Give your answer to 3 significant figures. [2]

(c) Draw a graph of $P = 4^t + 100$, for values of t from 0 to 6. [3]

(d) Estimate from your graph the time taken for the bacteria population to reach 600. [2]

18.9.13 The population of a type of insect is falling at an exponential rate. The population P is known to be modelled by the equation $P = 1000 \times (½)^t$, where t is the time in weeks.

(a) Copy and complete the following table of results, giving each value of P to the nearest whole number. [3]

A	B	C	D	E	F	G	H	I	J	K	L
t	0	1	2	3	4	5	6	7	8	9	10
P			250								

(b) Plot a graph for the table of results above. [3]

(c) Estimate from your graph the population of insects after 3½ weeks. [2]

Exercise 18.10 · Sketching functions

18.10.1 Sketch the following linear functions showing clearly where the lines intersect both axes.

(a) $y = 2x - 4$	(b) $y = \frac{1}{2}x + 6$	(c) $y = -2x - 3$	(d) $y = -\frac{1}{3}x + 9$	(e) $2y + x - 2 = 0$	(f) $x = (2y + 4)/3$

18.10.2 Sketch the following quadratic functions, showing clearly where they intersect the y-axis and where/if they intersect the x-axis. Indicate also the coordinates of the turning point.

(a) $y = (x - 4)(x - 6)$	(b) $y = (x + 2)(-x + 3)$	(c) $y = (x - 4)^2 + 1$	(d) $y = -x^2 + 3x$
(e) $y = -x^2 + 4x - 4$	(f) $y = -x^2 - 12x - 37$	(g) $y = x^2 + 6x - 5$	(h) $y = -3x^2 + 6x - 5$

18.10.3 Sketch the following cubic functions, showing clearly where they intersect the axes.

(a) $y = (x + 1)(x - 2)(x - 4)$	(b) $y = (x - 3)^2(x + 2)$	(c) $y = (x)(x^2 - 10x + 25)$
(d) $y = -x(-x + 4)(x - 6)$	(e) $y = (2x - 1)(-2x^2 - 5x - 3)$	

Exercise 18.11 · Matching exponential and reciprocal graphs

18.11.1 Match each of the graphs below with a possible equation. (The figure shows five curves A to E on one pair of axes, two of them going through (0, 1); see the book, p. 214.) The equations are $y = 3/x$, $y = 2^{-x}$, $y = 1/x$, $y = -2/x$ and $y = 2^x$.

A	B	C	D	E

18.11.2 Match each of the graphs below with a possible equation. (The figure shows five curves A to E on one pair of axes, mostly below the x-axis; see the book, p. 214.) The equations are $y = 1/x$, $y = -3^x$, $y = 2/x$, $y = -1/x$ and $y = -5^x$.

A	B	C	D	E

Student assessment 1

SA1.1 Sketch the graph of the function $y = 1/x$.

SA1.2 (a) Copy and complete the table below for the function $y = -x^2 - 7x - 12$. [3]

A	B	C	D	E	F	G	H	I	J	K
x	−7	−6	−5	−4	−3	−2	−1	0	1	2
y		−6				−2				

(b) Plot a graph of the function. [3]

SA1.3 Plot a graph of each of the functions below between the given limits of x.

(a) $y = x^2 - 3x - 10, -3 \leq x \leq 6$ [3]

(b) $y = -x^2 - 4x - 4, -5 \leq x \leq 1$ [3]

SA1.4 (a) Plot the graph of the quadratic equation $y = -x^2 - x + 15$ for $-6 \leq x \leq 4$. [3]

(b) Showing your method clearly, use your graph to solve the following equations: [4]

(i) $10 = x^2 + x$

(ii) $x^2 = x + 5$

SA1.5 (a) Plot the graph of $y = 2/x$ for $-4 \leq x \leq 4$. [3]

(b) Showing your method clearly, use your graph to solve the equation $x^2 + x = 2$. [3]

SA1.6 In each of the following equations:

(i) State whether the turning point is maximum or a minimum, giving a reason for your answer.

(ii) State the coordinate of the turning point.

(a) $y = -(x + 3)^2 - 5$	(b) $y = \frac{1}{2}(x - 6)^2 + 2$

SA1.7 Sketch the function $y = \frac{1}{2}x^2 - 2$, showing clearly where it intersects both axes and indicating the coordinates of the turning point. [4]

SA1.8 Sketch the function $y = (3x + 2)(-x^2 - x + 2)$, indicating clearly the intersections with both axes. [4]

Student assessment 2

SA2.1 (a) Name the types of graph shown below. (Figure (i) is a straight line sloping downwards from top left to bottom right, crossing the x-axis to the right of the y-axis. Figure (ii) is an ∩-shaped curve symmetrical about the y-axis, with its highest point above the x-axis.) [2]

(b) Give a possible equation for each of the graphs drawn. [2]

SA2.2 For each of the functions below:

(i) draw up a table of values,

(ii) plot a graph of the function.

(a) $f(x) = x^2 + 3x, -5 \le x \le 2$	(b) $f(x) = 1/x + 3x, -3 \le x \le 3$

SA2.3 (a) Plot the function $y = \frac{1}{2}x^3 + 2x^2$ for $-5 \le x \le 2$. [3]

(b) Calculate the gradient of the curve when: [4]

(i) $x = 1$

(ii) $x = -1$

SA2.4 (a) Plot a graph of the function $y = 2x^2 - 5x - 5$ for $-2 \le x \le 5$. [3]

(b) Use the graph to solve the equation $2x^2 - 5x - 5 = 0$. [2]

(c) Showing your method clearly, use the graph to solve the equation $2x^2 - 3x = 10$. [3]

SA2.5 Sketch the function $(y + 2)/3 = x$. [3]

SA2.6 Sketch the function $y = -2x^2 + x + 15$, stating clearly where it intersects the axes and indicating the coordinates of the turning point. [5]

SA2.7 A builder is constructing a fenced yard off the side of a house as shown. The total length of the fence is 60 m. (The figure shows a rectangle against the house wall: the two sides at right angles to the house are each marked x and the side parallel to the house is marked x + 2 together with an unmarked side.)

(a) Write an expression for the length of the unmarked side in terms of x. [2]

(b) Write an equation for the area A of the yard. [2]

(c) Sketch the graph of the function for the area A of the yard. [3]

(d) From your graph deduce the value of x which gives the largest area for the yard. [2]

(e) Calculate the largest area possible for the yard. [2]

Student assessment 3

SA3.1 (a) Name the types of graph shown below. (Figure (i) is a curve in two parts: the left part lies above the x-axis and rises steeply beside the y-axis, the right part lies below the x-axis. Figure (ii) is a curve rising from left to right, flat on the left and steep on the right, crossing the y-axis above the origin.) [2]

(b) Give a possible equation for each of the graphs drawn. [2]

SA3.2 For each of the functions below:

(i) draw up a table of values,

(ii) plot a graph of the function.

(a) $f(x) = 2^x + x$, $-3 \le x \le 3$	(b) $f(x) = 3^x - x^2$, $-3 \le x \le 3$

SA3.3 (a) Plot the function $y = -x^3 - 4x^2 + 5$ for $-5 \leq x \leq 2$. [3]

(b) Calculate the gradient of the curve when: [4]

(i) $x = 0$

(ii) $x = -2$

SA3.4 (a) Copy and complete the table below for the function $y = 1/x^2 - 5$. [3]

A	B	C	D	E	F	G	H	I	J	K	L
x	−3	−2	−1	−0.5	−0.25	0	0.25	0.5	1	2	3
y			−1			—					

(b) Plot a graph of the function. [3]

(c) Use the graph to solve the equation $1/x^2 = 5$. [2]

(d) Showing your method clearly, use your graph to solve the equation $1/x^2 + x^2 = 7$. [3]

SA3.5 (a) Sketch the graph of $y = -2^x$ indicating clearly any intersections with either axis. [3]

(b) Give the equation of any asymptote(s). [1]

SA3.6 (a) Sketch the graph of $y = 2^x - 4$ indicating clearly any intersections with either axis. [3]

(b) Give the equation of any asymptote(s). [1]

SA3.7 A cuboid with side lengths x cm, x cm and y cm is shown below. Its total surface area is 392 cm^2.

(a) Show that the length y can be written as $y = (196 - x^2)/(2x)$. [3]

(b) Write an equation for the volume V of the cuboid in terms of x. [2]

(c) Sketch a graph for the volume V of the cuboid for values of x in the range $-14 \leq x \leq 14$. [3]

(d) Using your graph as a reference, calculate the integer value of x which will produce the greatest volume. [2]

(e) Using your answer to part d, calculate the maximum volume of the cuboid. [2]

Check yourself

1 For $y = x^2 - 6x + 5$, find where the graph crosses the x-axis and the y-axis, and the coordinates of the turning point. [4]

2 The graph of $y = x^2 - 2x - 3$ is drawn. Which straight line must you draw on it to solve $x^2 - 2x - 3 = 5$? Explain why. [2]

3 Explain how to find the gradient of a curve at a point, and why it is only an estimate. [2]

4 Write down the equations of the asymptotes of $y = 1/x + 4$, and explain what an asymptote is. [3]

5 Sketch $y = (x + 1)(x - 2)(x - 5)$, marking every point where it meets the axes. [4]

Chapter quiz

Q1 What shape is the graph of $y = x^2 - 5x + 6$?

A	B	C	D
A straight line	A U-shaped parabola	An ∩-shaped parabola	A hyperbola

Q2 For $y = x^2 - 3x + 1$, what is y when $x = -2$?

A	B	C	D
−1	3	11	−9

Q3 The graph of $y = x^2 - x - 6$ crosses the x-axis at which x values?

A	B	C	D
x = 3 and x = −2	x = −3 and x = 2	x = 6 and x = −1	x = −6 only

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Q4 You have the graph of $y = x^2 - 4x + 3$. Which line do you draw to solve $x^2 - 4x - 1 = 0$?

A	B	C	D
y = −1	y = 4	y = 1	y = −4

Q5 What is the turning point of $y = (x - 2)^2 + 5$?

A	B	C	D
(−2, 5)	(2, −5)	(2, 5)	(5, 2)

Q6 Describe the turning point of $y = -3(x + 1)^2 + 4$.

A	B	C	D
Minimum at (−1, 4)	Maximum at (−1, 4)	Maximum at (1, 4)	Minimum at (1, −4)

Q7 Which name fits the graph of $y = 4/x$?

A	B	C	D
Parabola	Cubic curve	Hyperbola	Straight line

Q8 Every graph of the form $y = a^x$ (with $a > 0$) passes through which point?

A	B	C	D
(1, 0)	(0, 1)	(0, 0)	(1, 1)

Q9 A tangent to a curve passes through (1, 3) and (3, 11). What is the gradient of the curve there?

A	B	C	D
2	4	8	0.25

Q10 Where does the line $y = 3x - 6$ cross the x-axis?

A	B	C	D
(0, −6)	(2, 0)	(−2, 0)	(6, 0)

Q11 Where does $y = (x - 1)(x - 4)(x + 2)$ cross the y-axis?

A	B	C	D
(0, −8)	(0, 8)	(0, 7)	(0, 4)

Q12 What are the asymptotes of $y = 1/x^2 + 3$?

A	B	C	D
x = 0 and y = 3	x = 3 and y = 0	y = 0 only	x = 0 and y = −3

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/o-level-mathematics/chapter-18-graphs-of-functions/