A Level · Edexcel · Maths

3 hours 40 questions

2.7 Graphs of Functions

2.7.1 Sketching Polynomials / 2.7.2 Reciprocal Graphs - Sketching / 2.7.3 Solving Equations Graphically / 2.7.4 Proportional Relationships

Easy (10 questions)	/38
Medium (10 questions)	/50
Hard (10 questions)	/49
Very Hard (10 questions)	/54
Total Marks	**/191**

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Easy Questions

1 Sketch the graph of $y = 6x - 12$, labelling any points where the graph intersects the coordinate axes.

(3 marks)

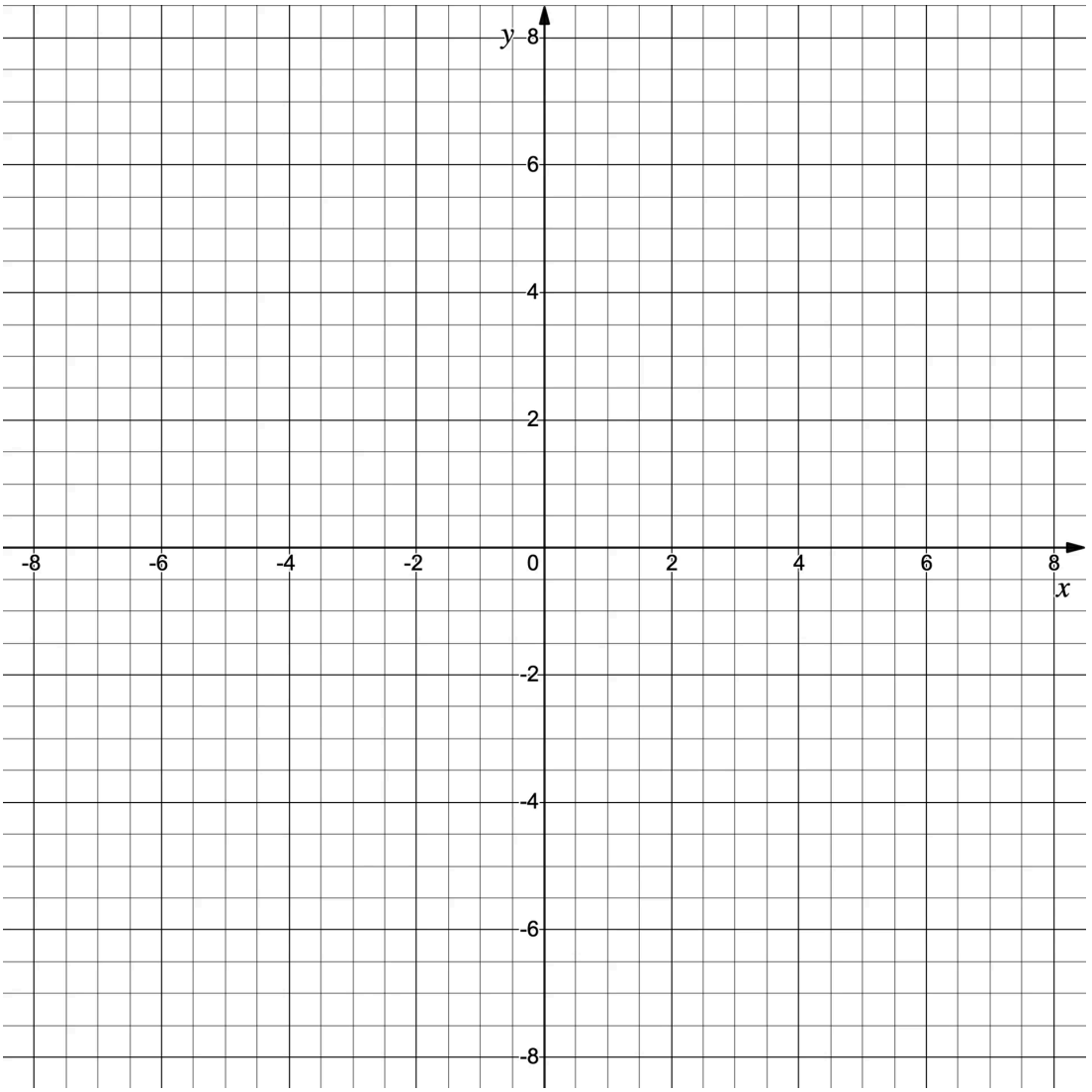
2 Sketch the graph of $y = x^2 - 1$, labelling any points where the graph intersects the coordinate axes.

(3 marks)

3 Sketch the graph of $y = \frac{1}{x}$, labelling any points where the graph intersects the coordinate axes and stating the equations of any asymptotes.

(3 marks)

4 (i) On the axes below, sketch the graphs of both $y = x$ and $y = -x + 2$.



(ii) Using your graph, or otherwise, find the solution to the simultaneous equations

$y = x$ and $y = -x + 2$.

(3 marks)

5 (a) (i) Write down the value of $x^2 + 3x - 4$ when $x = 0$.

(ii) Factorise $x^2 + 3x - 4$

(2 marks)

(b) Sketch the graph of $y = x^2 + 3x - 4$, labelling any points where the graph intersects the coordinate axes.

(3 marks)

6 (a) Express $2x^3 + 2x^2 - 12x$ in the form $ax(x + b)(x + c)$, where a, b and c are integers to be found.

(2 marks)

(b) Hence sketch the graph of $y = 2x^3 + 2x^2 - 12x$ labelling any points where the graph intersects the coordinate axes.

(3 marks)

7 y is proportional to x.

When $x = 2$, $y = 10$.

(i) Find the constant of proportionality

(ii) Sketch the graph of y against x.

(3 marks)

8 By sketching the graphs of $y = x^3$ and $y = \frac{1}{x}$ on the same diagram show that there are two real solutions to the equation $x^3 = \frac{1}{x}$.

(3 marks)

9 (a) Use the factor theorem to show that $(x-2)$ is a factor of the function

$$f(x) = x^3 - 2x^2 - 4x + 8.$$

(2 marks)

(b) Hence, or otherwise, express $f(x)$ as a product of three linear factors.

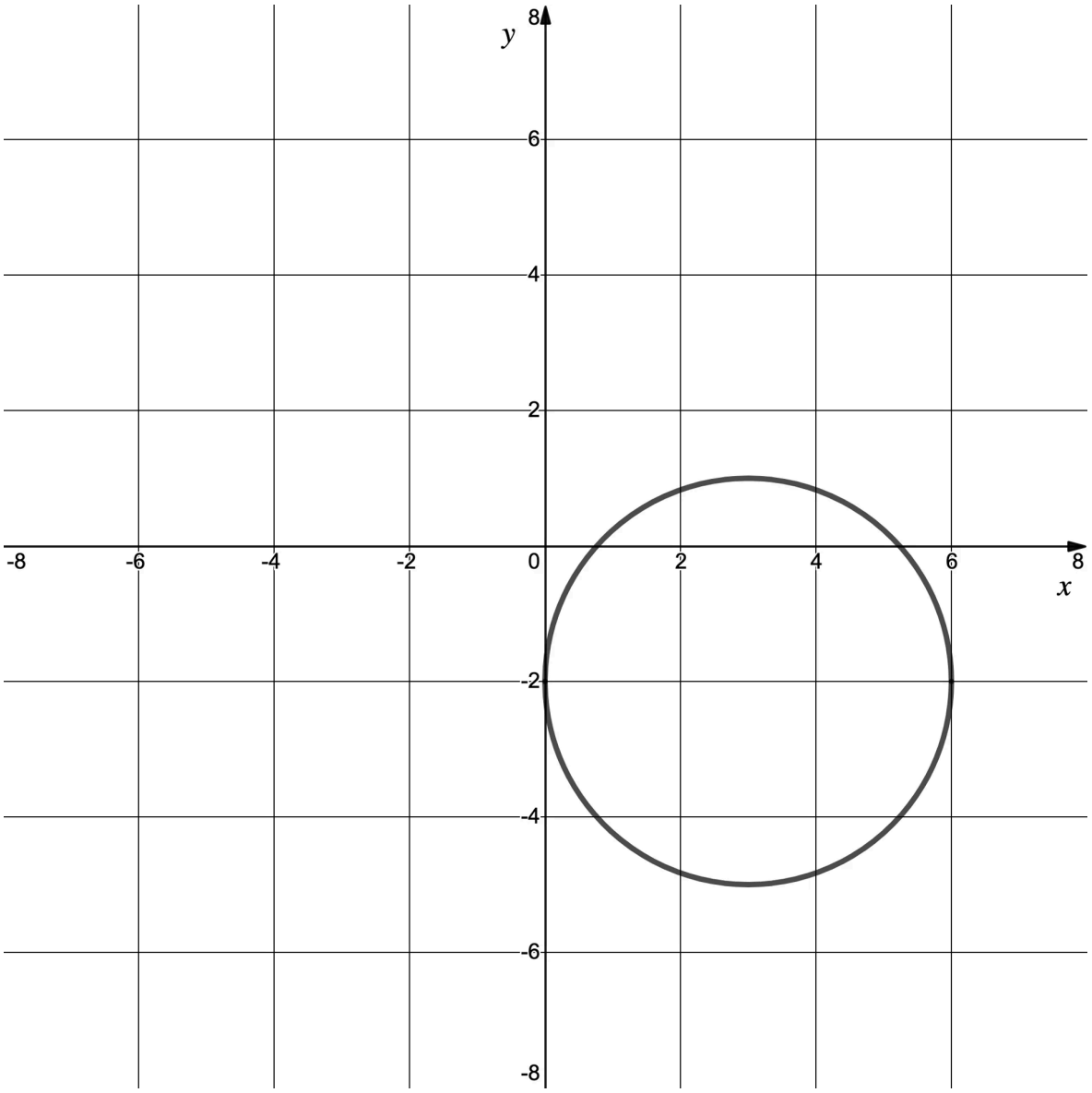
(2 marks)

(c) Sketch the graph of $y = f(x)$ labelling any points where the graph intersects the coordinate axes.

(3 marks)

10 The diagram below shows the graph of a circle with equation $(x-3)^2 + (y+2)^2 = 9$.

Add straight lines passing through the point to the diagram to show how the circle can have either no, one or two intercepts. All lines must pass through the point $(6, -4)$.



(3 marks)

Medium Questions

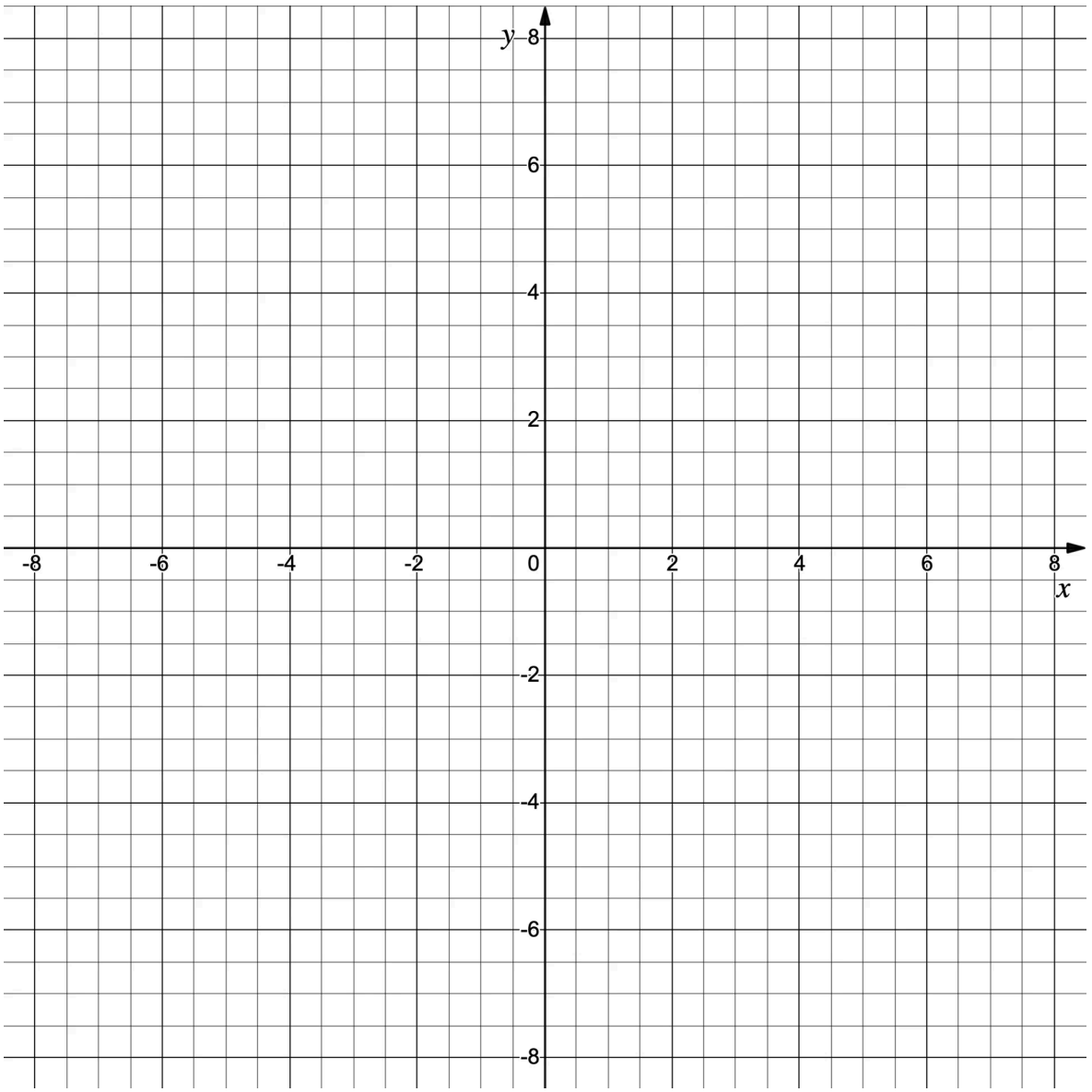
1 Sketch the graph of $y = (x + 3)^3$ labelling any points where the graph intersects the coordinate axes.

(3 marks)

2 Sketch the graph of $y = \frac{1}{x^2}$ and write down the equations of any asymptotes.

(2 marks)

3 (a) On the axes below sketch the graphs of both $y = 3x - 2$ and $y = x + 4$.



(2 marks)

(b) Using your graph, or otherwise, find the solution to the simultaneous equations

$3x - y = 2$ and
$x - y = -4$.

(1 mark)

4 y is inversely proportional to x. When $x = 3$, $y = 12$. Find the constant of proportionality and sketch the graph of y against x.

(3 marks)

5 Sketch the graph of $y = 2x^2(x + 3)$ labelling any points where the graph intersects the coordinate axes.

(3 marks)

6 (a) On the same diagram, sketch the graphs of $y = x(x+2)(x-1)$ and $y = \frac{1}{x}$.

(3 marks)

(b) Use your graph to determine the number of solutions to the equation

$$x(x+2)(x-1) = \frac{1}{x}.$$

(1 mark)

7 (a) A machine computes a calculation in time, t seconds, that is proportional to the number of processes, p, involved. For a calculation involving 10 processes the machine takes 0.01 seconds.

Show that the constant of proportionality is 0.001.

(2 marks)

(b) Hence write down an equation linking the number of processes (p) to the time taken (t).

(2 marks)

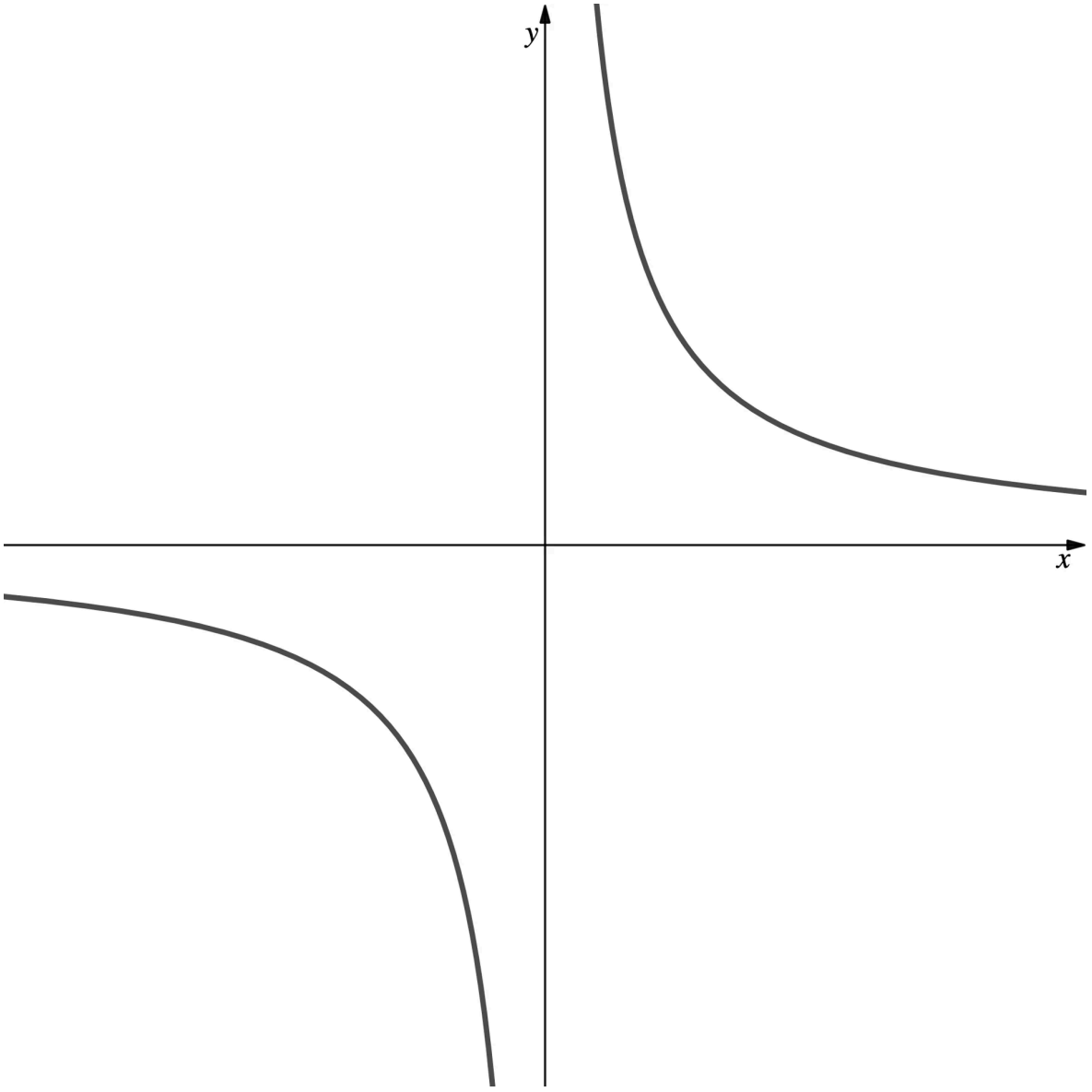
(c) Find the time it takes for the machine to compute a calculation involving 200 processes.

(2 marks)

(d) How many processes are involved for a calculation taking 2.3 seconds?

(2 marks)

8 (a) The diagram below shows the graph of $y = \frac{a}{x}$, where $a > 0$.



Sketch the graph of $y = \frac{a}{x}$, where $a < 0$.

(2 marks)

(b) State which graph the following points must lie on and find the value of a in each case.

(i) $(-4, -5)$

(ii) $(-0.02, 250)$

(4 marks)

9 (a) Show that $(x+2)$ is a factor of $2x^3-3x^2-11x+6$.

(1 mark)

(b) Fully factorise $2x^3-3x^2-11x+6$.

(2 marks)

(c) Sketch the graph of $y=2x^3-3x^2-11x+6$.
Label any points where the graph crosses the coordinate axes.

(4 marks)

10 (a) Solve the equation $x^3 - x^2 - 2x + 4 = 4x + 4$.

(3 marks)

(b) Write down the x-coordinates of the points of intersection between the graphs of $y = x^3 - x^2 - 2x + 4$ and $y = 4x + 4$.

(2 marks)

(c) Find the y-coordinates of the points of intersection between the graphs of $y = x^3 - x^2 - 2x + 4$ and $y = 4x + 4$.

(2 marks)

(d) On the same diagram, sketch the graphs of $y = x^3 - x^2 - 2x + 4$ and $y = 4x + 4$.

(4 marks)

Hard Questions

1 Given that $(x+1)$ is a factor of x^3-4x^2+x+6, sketch the graph of $y=x^3-4x^2+x+6$. Label any points where the graph intersects the coordinate axes.

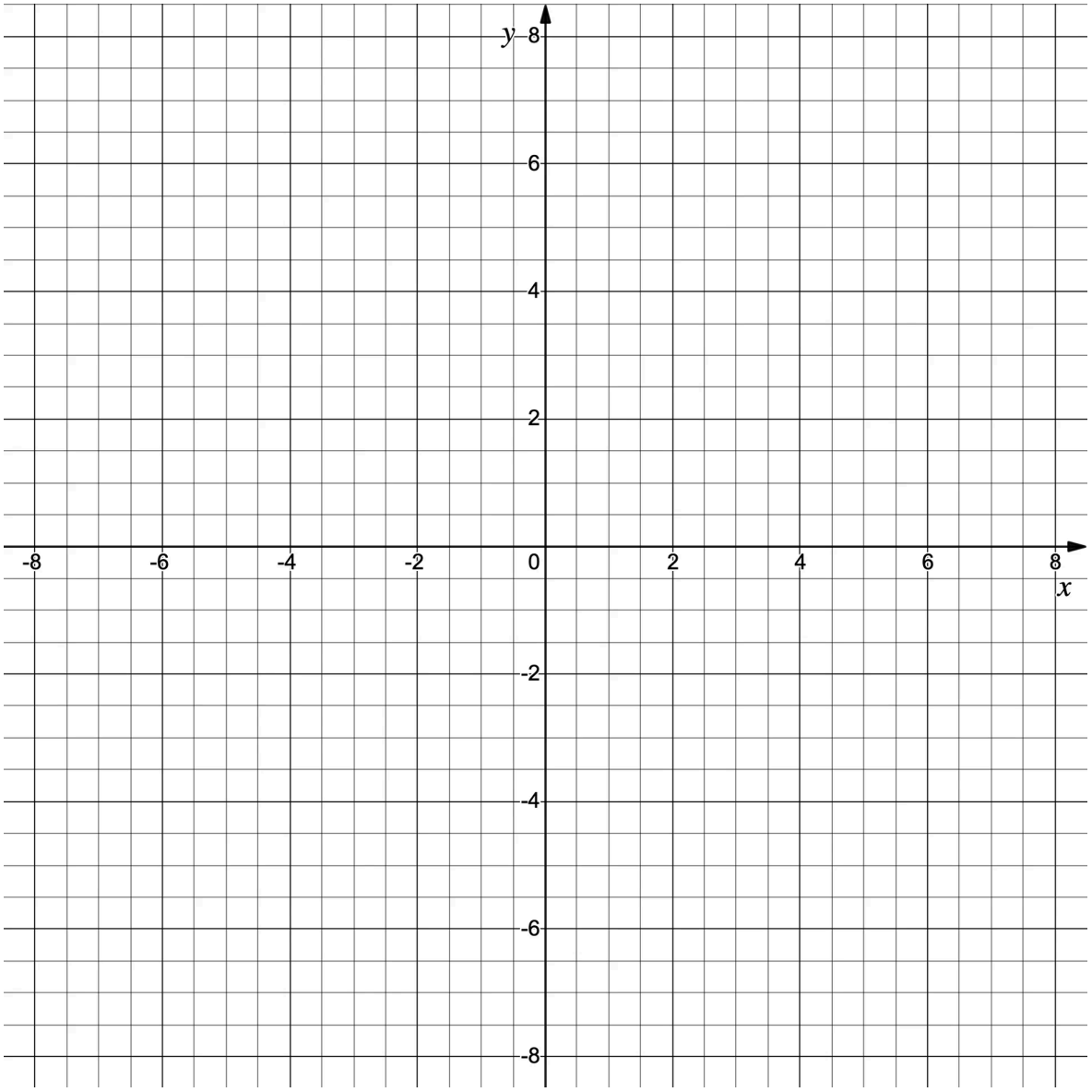
(There is no need to label any stationary points.)

(4 marks)

2 Sketch the graph of $y=\frac{-2}{x^2}$ and write down the equations of any asymptotes.

(2 marks)

3 (a) On the axes below sketch the graphs of both $y = x^2 + 2x - 3$ and $y = x - 1$.



(3 marks)

(b) Using your graph, or otherwise, find the solutions to the simultaneous equations

$$y = (x + 3)(x - 1)$$
$$x - y = 1$$

(2 marks)

4 y is inversely proportional to x. When $x = 2$, $y = 10$. Find the constant of proportionality and sketch the graph of y against x.

(4 marks)

5 Sketch the graph of $y = 3x^3 - 2x^2 - x$ labelling any points where the graph intersects the coordinate axes.

(3 marks)

6 (a) On the same diagram, sketch the graphs of $y = x^3 - 2x^2 - 8x$ and $y = \frac{1}{x}$.

(3 marks)

(b) Use your graph to determine the number of solutions to the equation

$$x^3 - 2x^2 - 8x = \frac{1}{x}.$$

(1 mark)

7 (a) A machine computes a calculation in time, t seconds, that is proportional to the square of the number of processes, p, involved. For a calculation involving 8 processes the machine takes 0.032 seconds.

Find an equation linking the number of processes, (p) to the time taken, (t) seconds.

(3 marks)

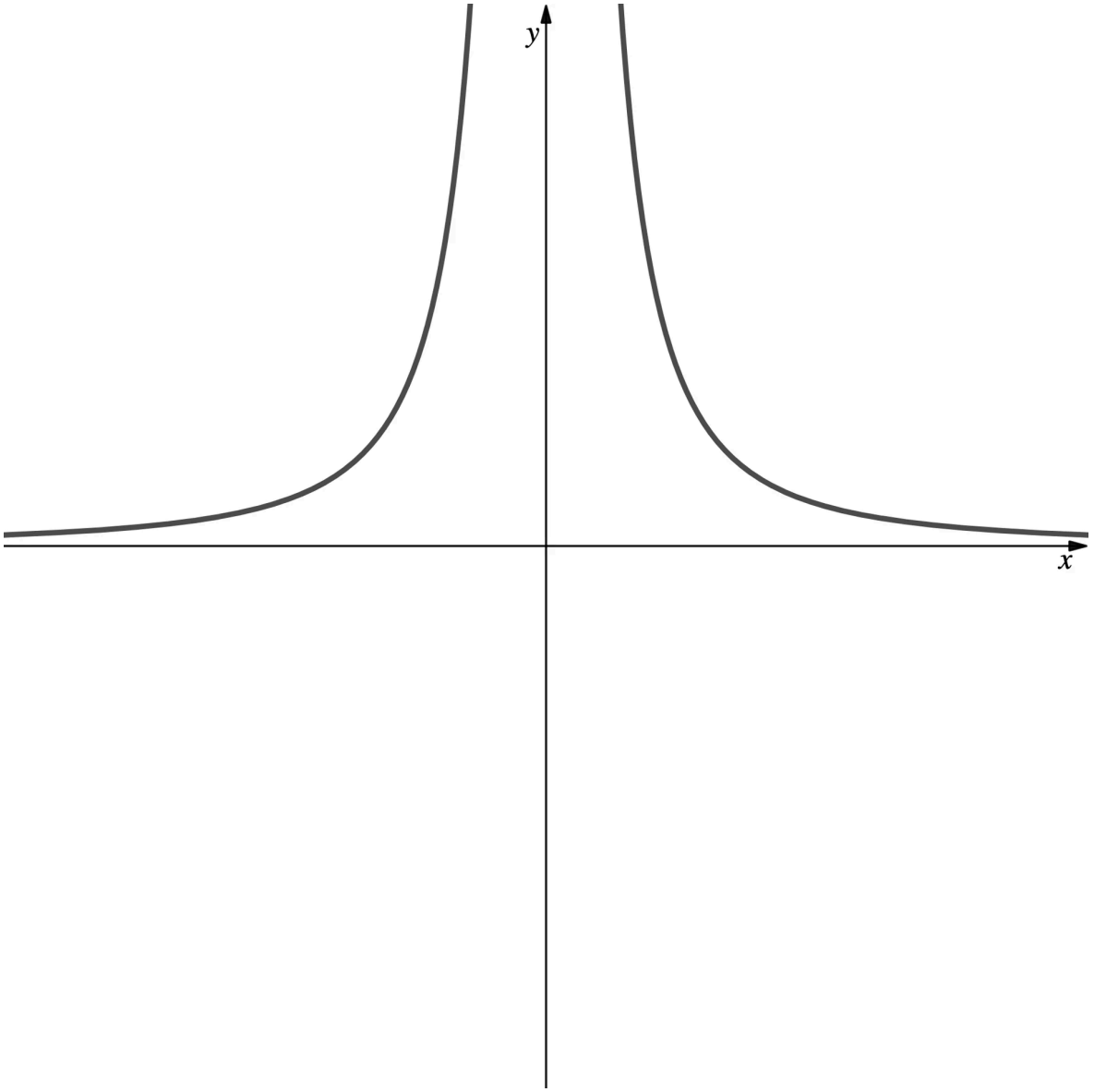
(b) How many processes are involved for a calculation taking 0.2 seconds?

(2 marks)

(c) Find the time it takes for the machine to compute a calculation involving 30 processes.

(2 marks)

8 (a) The diagram below shows the graph of the equation $y = \frac{a}{x^2}$, where $a > 0$.



Sketch the graph of $y = \frac{a}{x^2}$, where $a < 0$.

(2 marks)

(b) Given that m is a negative real number, state with a reason, which graph passes through the point (m, m^4).

(2 marks)

9 (a) Show that $(x+3)$ is a factor of the function $f(x)=6x^3+23x^2+11x-12$ and hence, or otherwise, fully factorise $f(x)$.

(3 marks)

(b) Sketch the graph of $y=f(x)$.
Label any points where the graph crosses the coordinate axes.

(4 marks)

10 (a) Find the coordinates of the points of intersection between the curve with equation $y = x^3 - x^2 - 4x + 4$ and the line with equation $y = 2x + 4$.

(4 marks)

(b) On the same diagram, sketch the graphs of $y = x^3 - x^2 - 4x + 4$ and $y = 2x + 4$.
Label the coordinates of any points of intersection between the two graphs.
Also label any points where the graphs intersect the coordinate axes.

(5 marks)

Very Hard Questions

1 $(x-2)$ and $(x+3)$ are factors of $f(x)$, where $f(x)=x^4-9x^3+9x^2+85x-150$.

Sketch the graph of $y=f(x)$ labelling any points where the graph intersects the coordinate axes. (There is no need to label any stationary points).

(5 marks)

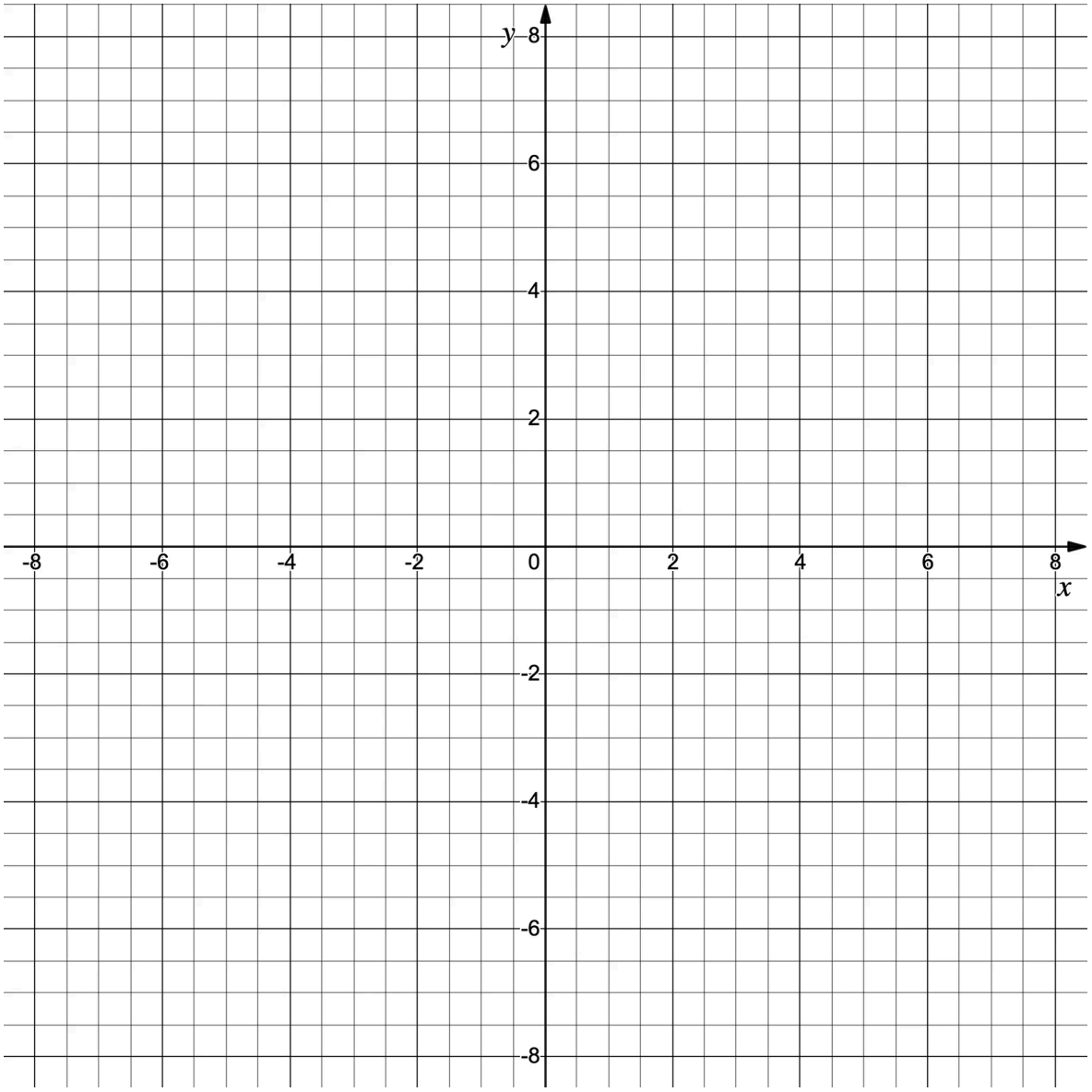
2 (a) On the same diagram, sketch the graphs of $y = \frac{1}{x^2}$ and $y = \frac{-3}{x^2}$.

(3 marks)

(b) Write down the equation(s) of any lines of symmetry and asymptotes for the two graphs in part (a).

(2 marks)

3 (a) On the axes below sketch the graphs of both $y=(x-1)^2$ and $y=2-x^2-x$.



(3 marks)

(b) Using your graph, or otherwise, find the solutions to the equation

$$x^2-2x+1=2-x^2-x.$$

(2 marks)

4 y is inversely proportional to the square of x. When $x = 4$, $y = 8$. Find the constant of proportionality and sketch the graph of y against x.

(4 marks)

5 Sketch the graph of $y = 3x^3 + 2x^2 - 3x + 10$ labelling any points where the graph intersects the coordinate axes.

(4 marks)

6 (a) On the same diagram, sketch the graphs of $y = x^3 - 3x^2 - 6x + 8$ and $y = \frac{3}{x^2}$.

(4 marks)

(b) Write down the number of solutions to the equation

$$x^5 - 3x^4 - 6x^3 + 8x^2 = 3.$$

(1 mark)

7 (a) A machine computes a calculation in time, t seconds, that is proportional to the cube root of the number of processes, p, involved. For a calculation involving 8 processes the computer takes 6.4×10^{-4} seconds.

How many processes are involved for a calculation taking 1.28×10^{-3} seconds?

(4 marks)

(b) Find the time it takes for the machine to compute a calculation involving 250 processes.

(2 marks)

8 (a) On separate diagrams, sketch the graphs of $y = \frac{a}{x^2}$, where $a > 0$ and $y = \frac{a}{x^2}$, where $a < 0$.

(3 marks)

(b) One of the graphs passes through the point with coordinates (m, m^6).

Write a in terms of m and, justifying your answer, state which graph this point must lie on.

(3 marks)

9 (a) Fully factorise $4x^3 + 17x^2 + 20x + 4$.

(3 marks)

(b) Sketch the graph of $y = 4x^3 + 17x^2 + 20x + 4$.
Label any points where the graph crosses the coordinate axes.

(2 marks)

10 On the same diagram, sketch the graphs of $4y = x^3 - 5x^2 - 12x + 36$ and $x + y - 6 = 0$.

Label the coordinates of any points of intersection between the two graphs.
Also label any points where the graphs intersect the coordinate axes.

(9 marks)