# IGCSE Mathematics Revision

## Session 5

| | | |
|---|---|---|
| **3.2 Function notation** | understand the concept that a function is a mapping between elements of two sets | |
| | use function notations of the form $f(x) = \ldots$ and $f : x \mapsto \ldots$ | |
| | understand the terms domain and range and which parts of a domain may need to be excluded | i.e. $f(x) = 1/x, \quad x \neq 0$ |
| | understand and use the notations composite function fg and inverse function $f^{-1}$ | 'fg' will mean '*do* g *first, then* f' |
| | find the gradients of non-linear graphs | By drawing a tangent |
| | find the intersection points of two graphs, one linear ($y_1$) and one non-linear ($y_2$), and recognise that the solutions correspond to the solutions of $y_2 - y_1 = 0$. | The $x$-values of the intersection of the two graphs $y = 2x + 1$, $y = x^2 + 3x - 2$ are the solutions of: $x^2 + x - 3 = 0$ Similarly, the $x$-values of the intersection of the two graphs $y = 5$, $y = x^3 - 3x^2 + 7$ are the solutions of: $x^3 - 3x^2 + 2 = 0$ |
| **3.4 Calculus** | understand the concept of a variable rate of change | |
| | differentiate integer powers of $x$ | |
| | determine gradients, rates of change, turning points (maxima and minima) by differentiation and relate these to graphs | $y = x + \frac{9}{x}$. Find the coordinates of the maximum and minimum points |
| | distinguish between maxima and minima by considering the general shape of the graph | |
| | apply calculus to linear kinematics and to other simple practical problems | The displacement, $s$ metres, of a particle from a fixed point $O$ after $t$ seconds is given by $s = 24t^2 - t^3, \quad 0 \leq t \leq 20$. Find expressions for the velocity and the acceleration. |

f and g are functions.

$$f : x \mapsto 2x - 3$$
$$g : x \mapsto 1 + \sqrt{x}$$

(a) Calculate f (–4)

.....

**(2)**

(b) Given that f $(a) = 5$, find the value of $a$.

$a =$ .....

**(2)**

(c) Calculate gf (6)

.....

**(2)**

(d) Which values of $x$ cannot be included in the domain of g?

.....

**(1)**

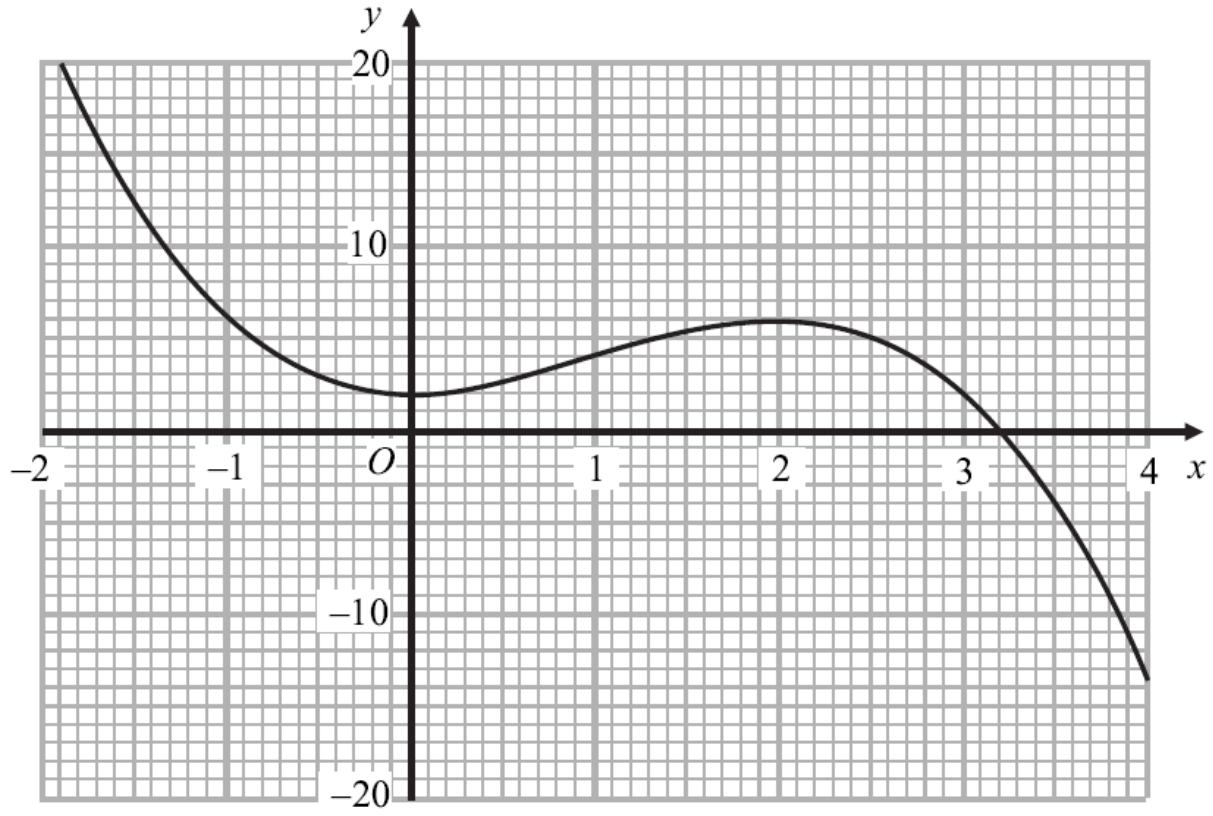
(e) Find the inverse function $g^{-1}$ in the form $g^{-1} : x \mapsto \ldots$

.....

**(3)**

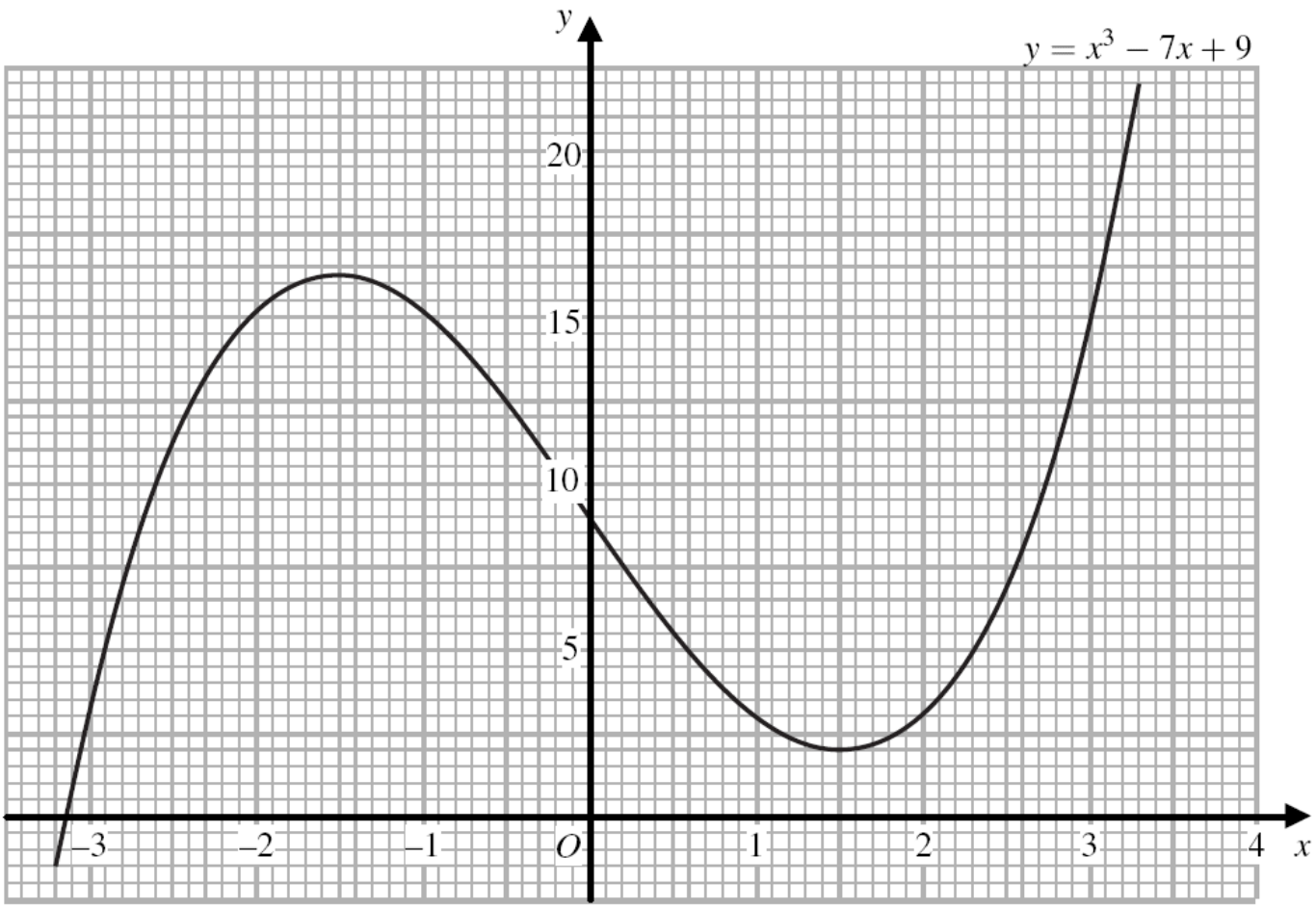
**(Total 10 marks)**

The diagram shows part of the graph of $y = f(x)$.




Find an estimate for the gradient of the curve at the point where $x = –1$

Part of the graph of $y = x^3 - 7x + 9$ is shown on the grid.

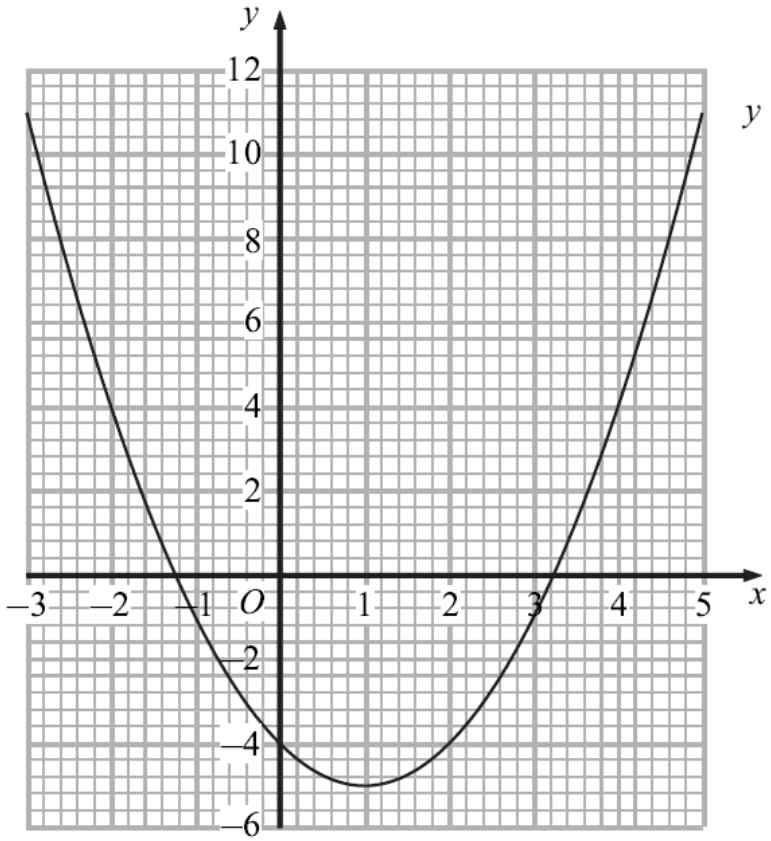



The graph of $y = x^3 - 7x + 9$ and the line with equation $y = k$, where $k$ is an integer, have 3 points of intersection.

(a) Find the greatest possible value of the integer $k$.

(b) By drawing a suitable straight line on the grid, find estimates of the solutions of the equation $x^3 - 6x - 2 = 0$.
Give your answers correct to 1 decimal place.

Part of the graph of $y = x^2 - 2x - 4$ is shown on the grid.




(a) Write down the coordinates of the minimum point of the curve.

( ..... , ..... )

**(1)**

(b) Use the graph to find estimates of the solutions to the equation $x^2 - 2x - 4 = 0$
Give your answers correct to 1 decimal place.

.....

**(2)**

(c) Draw a suitable straight line on the grid to find estimates of the solutions of the equation $x^2 - 3x - 6 = 0$

.....

**(3)**

(d) For $y = x^2 - 2x - 4$

(i) find $\frac{dy}{dx}$,

.....

(ii) find the gradient of the curve at the point where $x = 6$

.....

**(4)**

A curve has equation $y = x^2 + \frac{16}{x}$

The curve has one turning point.

Find $\frac{dy}{dx}$ and use your answer to find the coordinates of this turning point.

A particle moves along a line.
For $t \geqslant 1$, the distance of the particle from $O$ at time $t$ seconds is $x$ metres, where

$$x = \frac{20}{t}$$

Find an expression for the acceleration of the particle.

11, 4, 14, x<0, $g^{-1}: x \mapsto (x-1)^2$

Between -10 and -8

16, draw y=x+11 to get -2.7 -0.25 2.9,

(a) (1 , -5), (b) -1.2 3.2, (c) Draw y=x+2 to get -0.8 and 4.8 (d) (i) 2x-2 (ii) 10

$\frac{dy}{dx} = 2x - 16x^{-2} \Rightarrow 2x - \frac{16}{x^2} = 0 \Rightarrow x = 2.$ Coords (2,12)

$\frac{dx}{dt} = -20t^{-2} \Rightarrow a = 40t^{-3}$