2.2 Further Functions & Graphs

Question Paper

Course	DP IB Maths
Section	2. Functions
Topic	2.2 Further Functions & Graphs
Difficulty	Medium

Time allowed: 90

Score: /73

Percentage: /100

Question 1a

A function is defined by $f(x) = 54x - 13, \quad -2 < x < 20.$

(a) Find the value of $f\left(\frac{5}{2}\right)$.

[1 mark]

Question 1b

(b) Write down the range of $f(x)$.

[2 marks]

Question 1c

(c) Find the value of $f^{-1}(122)$.

[2 marks]

Question 1d

(d) Write down the range of the inverse function.

[1 mark]

Question 2a

Consider the function $f(x) = -6x - 3$. The domain of $f(x)$ is $-5 \leq x \leq 3$.

(a) Find

(i) $f(2)$

(ii) x when $f(x) = 15$.

[2 marks]

Question 2b

(b) Find the range of $f(x)$.

[3 marks]

Question 2c

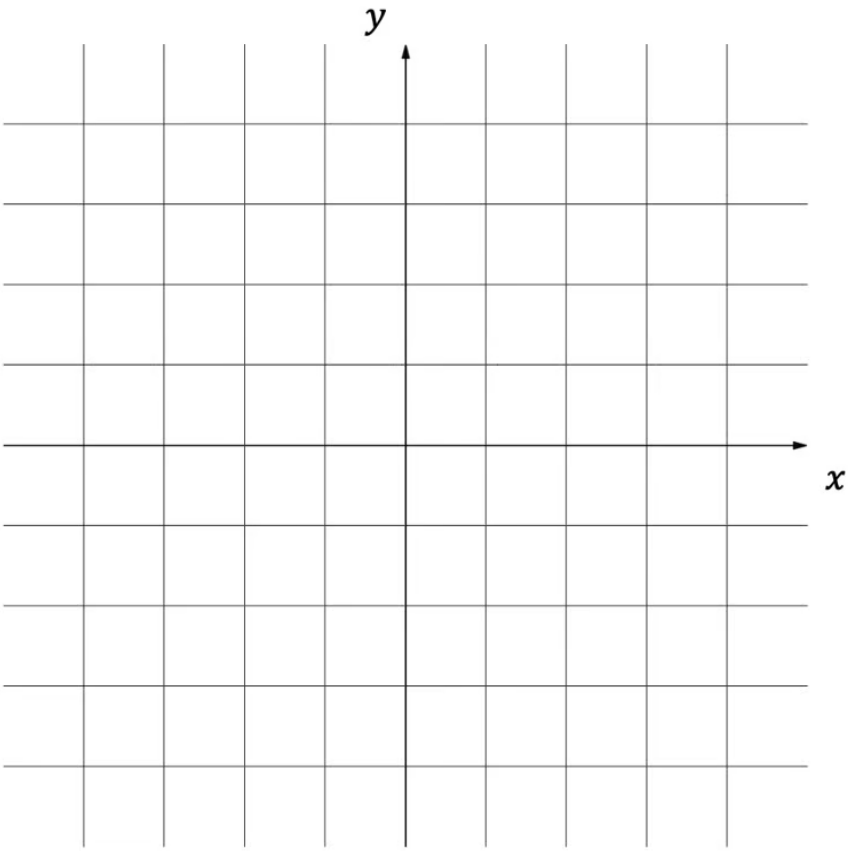
(c) Write down the domain of the inverse function.

[1 mark]

Question 3a

Consider the function $g(x) = \sqrt{4 - x}$.

(a) Sketch the graph of the function $g(x)$, labelling the x and y intercepts.



[3 marks]

Question 3b

(b) Find

(i) $g(-5)$

(ii) x when $g(x) = \frac{1}{2}$.

[2 marks]

Question 3c

(c) Find

(i) the maximum possible domain of the function $g(x)$

(ii) the range of the function $g(x)$ that corresponds to the domain found in part (c) (i).

[2 marks]

Question 4a

Consider the functions $f(x) = -x^5 + 2020$ and $g(x) = \frac{1}{\sqrt{(1-x)^3}} - 2$.

(a) Find the coordinates of the y-intercepts for the graph of

(i) f

(ii) g.

[2 marks]

Question 4b

(b) Find the coordinates of the x-intercepts for the graph of

(i) f

(ii) g.

[2 marks]

Question 4c

(c) For the graph of g, find the equation of

(i) the vertical asymptote

(ii) the horizontal asymptote.

[3 marks]

Question 5a

Consider the functions $f(x) = x^{-4} - 2021$ and $g(x) = 2 - \sqrt{x-1}$.

(a) Find the maximum possible domain and range of g.

[2 marks]

Question 5b

(b) For the graph of f, find the equation of

(i) the vertical asymptote

(ii) the horizontal asymptote.

[3 marks]

Question 5c

(c) Find the coordinates of the x-intercepts for the graph of

(i) f

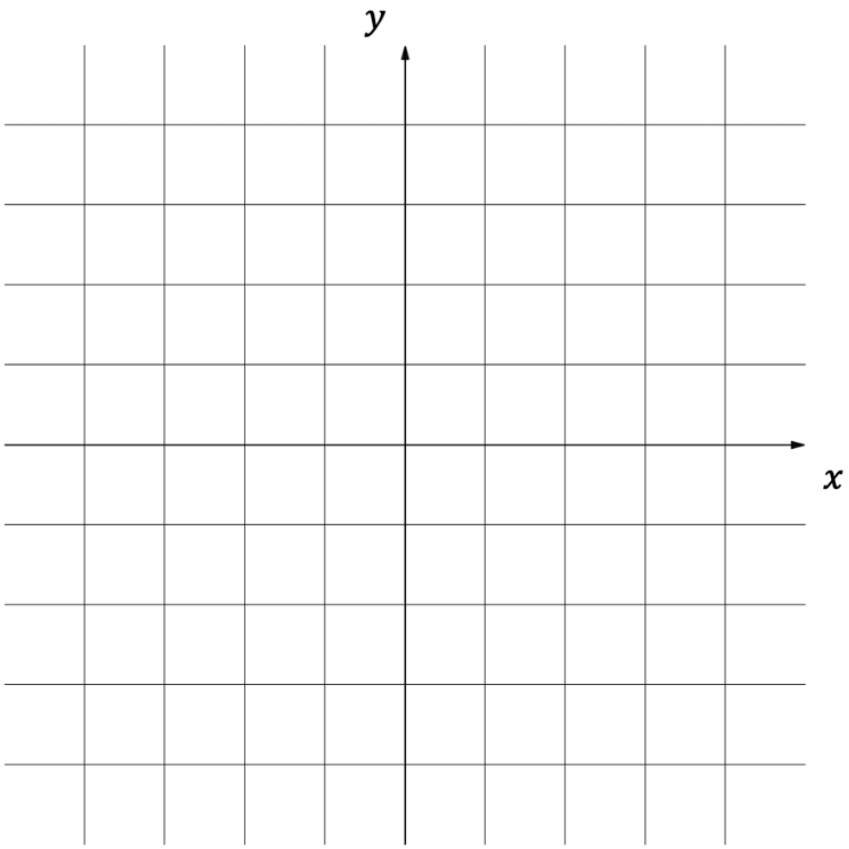
(ii) g.

[2 marks]

Question 6a

Consider the functions $f(x) = -x^2 - x + 6$ and $g(x) = (2x + 1)^2 - 9$.

(a) Sketch the graphs of the functions $f(x)$ and $g(x)$ and label the coordinates of the vertices for both functions.



[4 marks]

Question 6b

(b) Find the coordinates for the points of intersection of $f(x)$ and $g(x)$.

[2 marks]

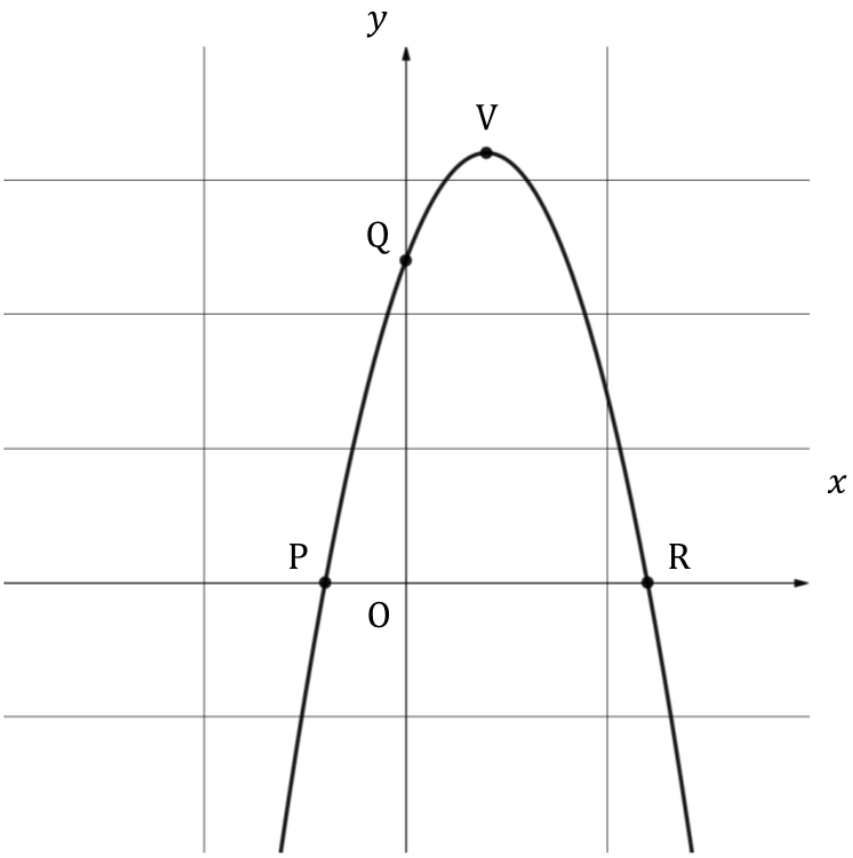
Question 6c

(c) Find the x-intercepts of $f(x)$ and $g(x)$.

[2 marks]

Question 7a

The diagram below shows part of the graph of the function $f(x) = -x^2 + bx + c$, where b and c are both integers. Points P(-2, 0) and R(6, 0) represent the x-intercepts, point Q(0, 12) represents the y-intercept, point V represents the vertex of the graph of f and O represents the origin (0, 0).



(a) Write down the value of c.

[1 mark]

Question 7b

(b) Find the value of b and write down $f(x)$.

[3 marks]

Question 7c

(c) Write down the coordinates of V.

[2 marks]

Question 8a

The function $g(x) = ax^2 + bx + c$ intercepts the y-axis at -16, has an x-intercept when $x = -4$ and can be obtained by an appropriate translation of the graph $y = 2x^2$.

(a) (i) Find the values of a, b and c.

(ii) Write down $g(x)$.

[4 marks]

Question 8b

(b) Find the other x-intercept of $g(x)$.

[1 mark]

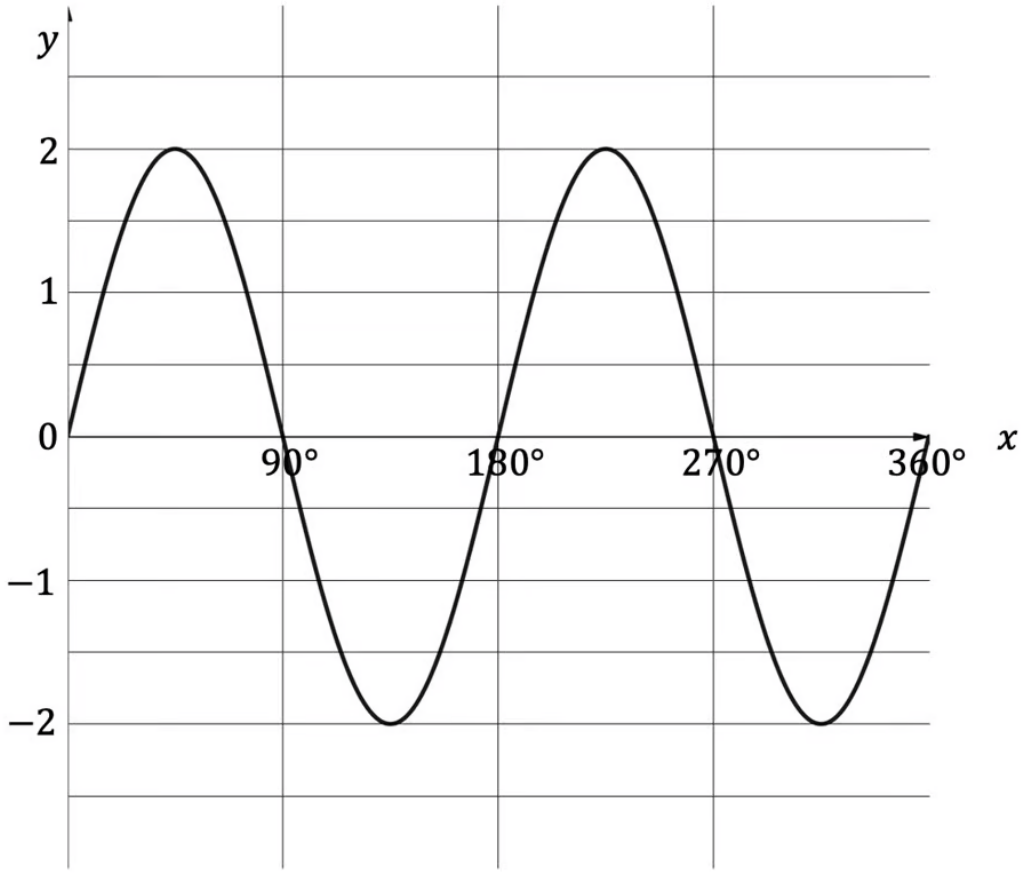
Question 8c

(c) Write down the coordinates of the vertex of $g(x)$.

[2 marks]

Question 9a

The diagram below shows the graph of the function $f(x) = 2\sin(2x)$ for $0° \leq x \leq 360°$.



(a) State the amplitude of $f(x)$.

[1 mark]

Question 9b

(b) Calculate the period of $f(x)$.

[2 marks]

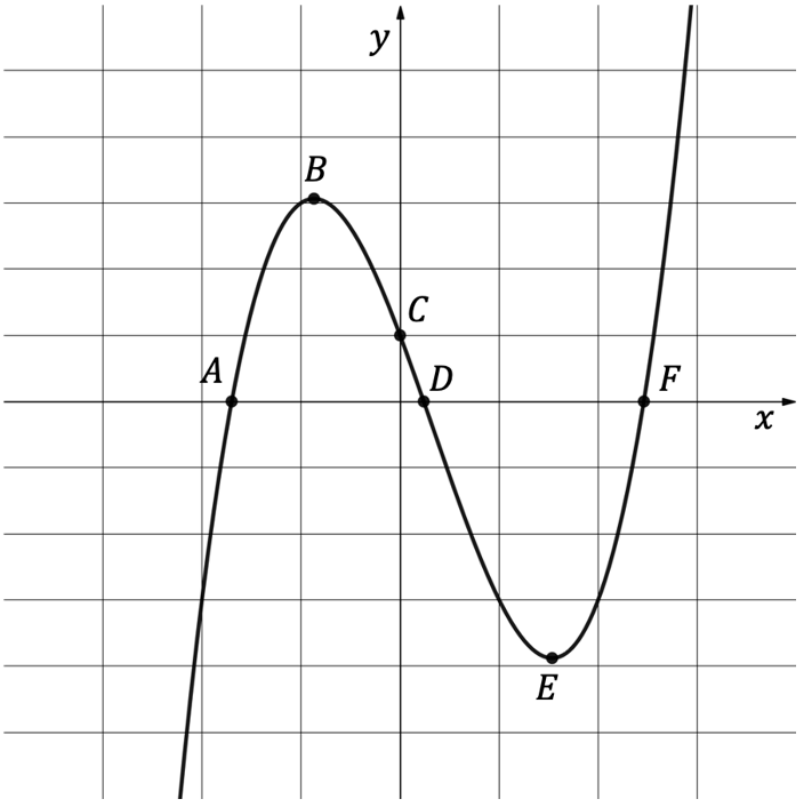
Question 9c

(c) Find the possible values of x when $f(x) = -1$.

[4 marks]

Question 10a

The diagram below shows part of the graph of the function $f(x) = x^3 - x^2 - 4x + 1$.



(a) Points A, C, D and F represent where the graph of f intersects the coordinate axes, write down the coordinates for

(i) A

(ii) C

(iii) D

(iv) F.

[4 marks]

Question 10b

(b) Points B and E represent the local maximum and minimum respectively for $f(x)$, write down the coordinates for

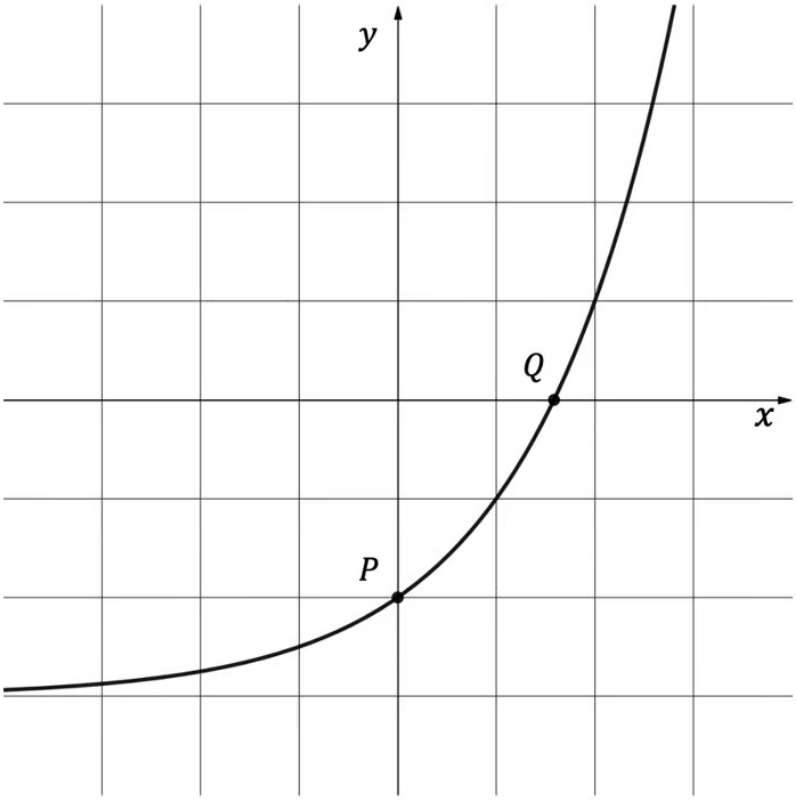
(i) B

(ii) E.

[2 marks]

Question 11a

The diagram below shows part of the graph of the function $f(x) = 2^x - 3$.



(a) Find

(i) $f(2)$

(ii) x when $f(x) = -1$.

[2 marks]

Question 11b

(b) The point P represents the y-intercept of $f(x)$. Write down the coordinates of P.

[1 mark]

Question 11c

(c) The point Q represents the x-intercept of $f(x)$. Write down the coordinates of Q.

[1 mark]

Question 11d

(d) (i) Draw the line $y = -3$ on the graph above.

(ii) Write down the number of solutions to the equation $f(x) = -3$.

[2 marks]