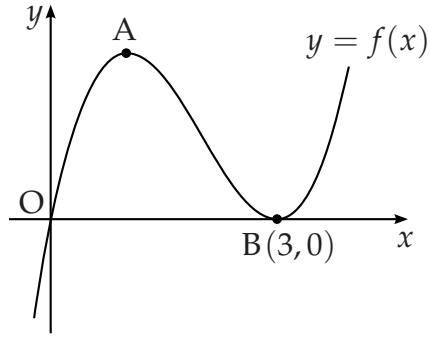
sp

[SQA] 1. A sketch of the graph of $y = f(x)$ where $f(x) = x^3 - 6x^2 + 9x$ is shown below.

The graph has a maximum at A and a minimum at $B(3, 0)$.



(*a*) Find the coordinates of the turning point at A. **4**

(*b*) Hence sketch the graph of $y = g(x)$ where $g(x) = f(x + 2) + 4$.

Indicate the coordinates of the turning points. There is no need to calculate the coordinates of the points of intersection with the axes. **2**

(*c*) Write down the range of values of k for which $g(x) = k$ has 3 real roots. **1**

[SQA] 2. A function f is defined by the formula $f(x) = (x - 1)^2(x + 2)$ where $x \in \mathbb{R}$.

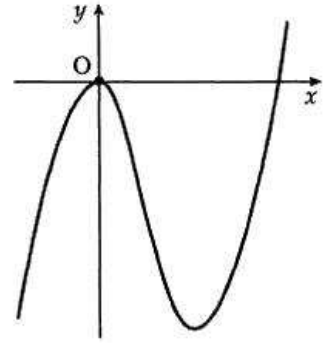
(*a*) Find the coordinates of the points where the curve with equation $y = f(x)$ crosses the x- and y-axes. **3**

(*b*) Find the stationary points of this curve $y = f(x)$ and determine their nature. **7**

(*c*) Sketch the curve $y = f(x)$. **2**

[SQA] 3. (*a*) The diagram shows a part of the curve with equation $y = 2x^2(x - 3)$. Find the coordinates of the stationary points on the graph and determine their nature. **(5)**

(*b*) State the range of values of k for which $y = k$ intersects the graph in three distinct points. **(2)**



[SQA] 4. A curve has equation $y = x^4 - 4x^3 + 3$.

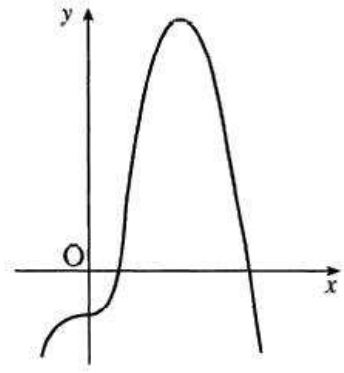
(*a*) Find algebraically the coordinates of the stationary points. **6**

(*b*) Determine the nature of the stationary points. **2**

[SQA] 5. **A curve has equation $y = -x^4 + 4x^3 - 2$. An incomplete sketch of the graph is shown in the diagram.**

(*a*) Find the coordinates of the stationary points. (6)

(*b*) Determine the nature of the stationary points. (2)



[SQA] 6. A curve has equation $y = 2x^3 + 3x^2 + 4x - 5$.

Prove that this curve has no stationary points. **5**

[SQA] 7. Find the coordinates of the turning points of the curve with equation $y = x^3 - 3x^2 - 9x + 12$ and determine their nature. **8**

[SQA] 8. A function f is defined on the set of real numbers by $f(x) = (x - 2)(x^2 + 1)$.

(*a*) Find where the graph of $y = f(x)$ cuts:

(i) the x-axis;

(ii) the y-axis. **2**

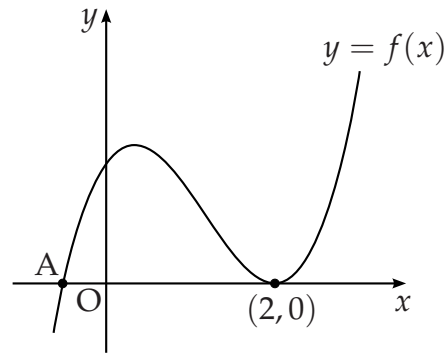
(*b*) Find the coordinates of the stationary points on the curve with equation $y = f(x)$ and determine their nature. **8**

(*c*) On separate diagrams sketch the graphs of:

(i) $y = f(x)$;

(ii) $y = -f(x)$. **3**

[SQA] 9. The diagram shows part of the graph of the curve with equation $y = 2x^3 - 7x^2 + 4x + 4$.

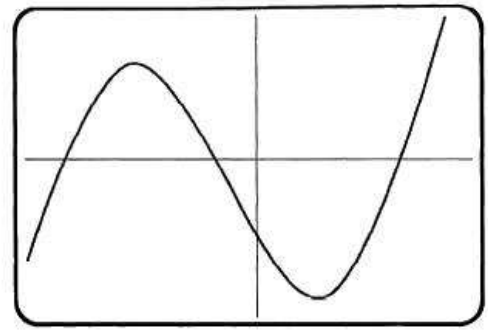


(*a*) Find the x-coordinate of the maximum turning point. **5**

(*b*) Factorise $2x^3 - 7x^2 + 4x + 4$. **3**

(*c*) State the coordinates of the point A and hence find the values of x for which $2x^3 - 7x^2 + 4x + 4 < 0$. **2**

[SQA] 10. The diagram shows part of the graph of the curve with equation $f(x) = x^3 + x^2 - 16x - 16$.

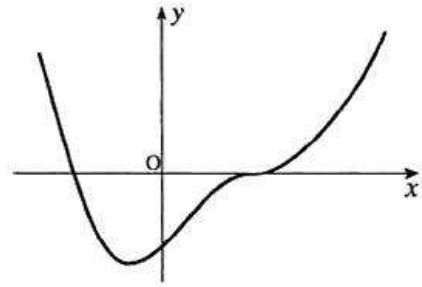


(*a*) Factorise $f(x)$. **(3)**

(*b*) Write down the co-ordinates of the four points where the curve crosses the x and y axes. **(2)**

(*c*) Find the turning points and justify their nature. **(6)**

[SQA] 11. The function f, whose incomplete graph is shown in the diagram, is defined by $f(x) = x^4 - 2x^3 + 2x - 1$.
Find the coordinates of the stationary points and justify their nature.



(8)

[SQA] 12. A function f is defined by the formula $f(x) = 4x^2(x-3)$ where $x \in \mathbb{R}$.

(*a*) Write down the coordinates of the points where the curve with equation $y = f(x)$ meets the x- and y-axes. **2**

(*b*) Find the stationary points of $y = f(x)$ and determine the nature of each. **6**

(*c*) Sketch the curve $y = f(x)$. **2**

(*d*) Find the area completely enclosed by the curve $y = f(x)$ and the x-axis. **4**

[END OF QUESTIONS]