Old Past Papers - Polynomials

[SQA] 1. (*a*) Express $f(x) = x^2 - 4x + 5$ in the form $f(x) = (x - a)^2 + b$. **2**

(*b*) On the same diagram sketch:

(i) the graph of $y = f(x)$;

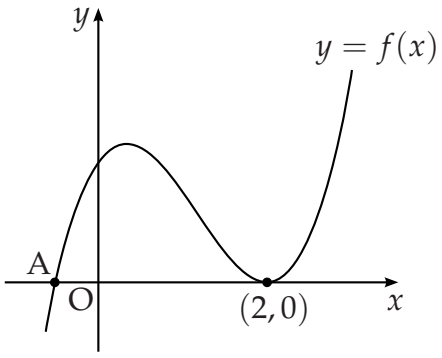
(ii) the graph of $y = 10 - f(x)$. **4**

(*c*) Find the range of values of x for which $10 - f(x)$ is positive. **1**

[SQA] 2. For what value of k does the equation $x^2 - 5x + (k + 6) = 0$ have equal roots? **3**

[SQA] 3. Show that the equation $(1 - 2k)x^2 - 5kx - 2k = 0$ has real roots for all integer values of k. **5**

[SQA] 4. 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**

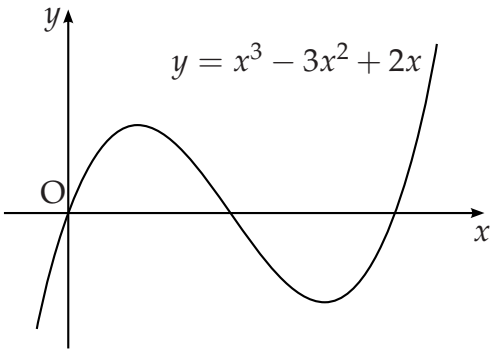
(*b*) Factorise $2x^3 - 7x^2 + 4x + 4$. **3**

(*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] 5. (*a*) Given that $x + 2$ is a factor of $2x^3 + x^2 + kx + 2$, find the value of k. **3**

(*b*) Hence solve the equation $2x^3 + x^2 + kx + 2 = 0$ when k takes this value. **2**

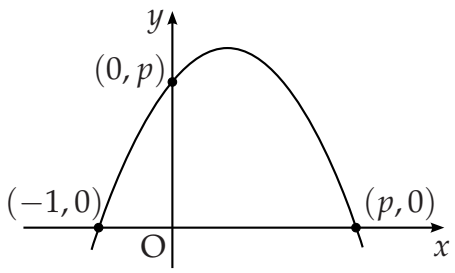
[SQA] 6. The diagram shows a sketch of the graph of $y = x^3 - 3x^2 + 2x$.



(*a*) Find the equation of the tangent to this curve at the point where $x = 1$. **5**

(*b*) The tangent at the point $(2, 0)$ has equation $y = 2x - 4$. Find the coordinates of the point where this tangent meets the curve again. **5**

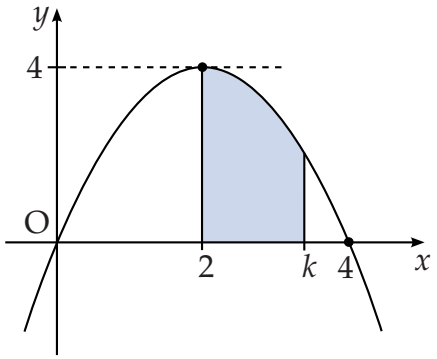
[SQA] 7. The diagram shows a sketch of a parabola passing through $(-1,0)$, $(0,p)$ and $(p,0)$.



(*a*) Show that the equation of the parabola is $y = p + (p-1)x - x^2$. **3**

(*b*) For what value of p will the line $y = x + p$ be a tangent to this curve? **3**

[SQA] 8. The parabola shown crosses the x-axis at $(0,0)$ and $(4,0)$, and has a maximum at $(2,4)$.



The shaded area is bounded by the parabola, the x-axis and the lines $x = 2$ and $x = k$.

(*a*) Find the equation of the parabola. **2**

(*b*) Hence show that the shaded area, A, is given by

$$A = -\tfrac{1}{3}k^3 + 2k^2 - \tfrac{16}{3}.$$ **3**

[SQA] 9. For what range of values of k does the equation $x^2 + y^2 + 4kx - 2ky - k - 2 = 0$ represent a circle? **5**

[END OF QUESTIONS]