Single Pure – Stationary Points

Find the stationary points on the following curves:

1. $y = x^2 + 2x + 3$. $\boxed{(-1, 2)}$

2. $y = x^2 - 3x + 7$. $\boxed{\left(\frac{3}{2}, \frac{19}{4}\right)}$

3. $y = 2x^2 + 3x + 5$. $\boxed{\left(-\frac{3}{4}, \frac{31}{8}\right)}$

4. $y = 3x^2 - 2x + 1$. $\boxed{\left(\frac{1}{3}, \frac{2}{3}\right)}$

5. $y = ax^2 + bx + c$. $\boxed{\left(-\frac{b}{2a}, c - \frac{b^2}{4a}\right)}$

6. $y = 2x^3 + 3x^2 - 36x + 4$. $\boxed{(2, -40) \text{ and } (-3, 85)}$

7. $y = 4x^3 - 27x^2 + 24x - 3$. $\boxed{(4, -83) \text{ and } \left(\frac{1}{2}, \frac{11}{4}\right)}$

8. $y = 2x^3 + x^2 - 4x + 1$. $\boxed{(-1, 4) \text{ and } \left(\frac{2}{3}, -\frac{17}{27}\right)}$

9. $y = -x^3 + 3x^2 + 9x - 1$. $\boxed{(3, 26) \text{ and } (-1, -6)}$

10. $y = x^3 - 2x^2 - x + 1$. (I only need the x-coordinates here, but in fully simplified surd form.) $\boxed{x = \frac{2 \pm \sqrt{7}}{3}}$

11. $y = 4x^3 + 24x^2 + 45x - 10$. $\boxed{\left(-\frac{3}{2}, \right) \text{ and } \left(-\frac{5}{2}, \right)}$

12. $y = 20x^3 + 39x^2 - 18x + 5$. $\boxed{\left(\frac{1}{5}, \right) \text{ and } \left(-\frac{3}{2}, \right)}$

13. $y = 2x^3 - 3px^2 - 3qx^2 + 6pqx + p$. $\boxed{(p,) \text{ and } (q,)}$

14. $y = 4x^3 + 3px^2 - 2qx^2 - 2pqx + 5$. $\boxed{\left(-\frac{p}{2}, \right) \text{ and } \left(\frac{q}{3}, \right)}$

15. $y = ax^3 + bx^2 + cx + d$. (I only need the x-coordinates here.) $\boxed{x = \frac{-b \pm \sqrt{b^2 - 3ac}}{3a}}$

16. $y = 4x + \dfrac{9}{x}$. $\boxed{\left(\frac{3}{2}, \right) \text{ and } \left(-\frac{3}{2}, \right)}$

17. $y = 4x^2 - \dfrac{1}{x} + 1$. $\boxed{\left(\frac{1}{2}, 0\right)}$

18. $y = \sqrt{x}\left(\dfrac{2x^2}{5} - \dfrac{2x}{3}\right)$. $\boxed{(0, 0) \text{ and } \left(1, -\frac{4}{15}\right)}$

19. $y = \dfrac{2x\sqrt{x}}{21}\left(3x^2 - 7\right)$. $\boxed{(0, 0) \text{ and } \left(1, -\frac{8}{21}\right)}$

Only attempt the rest if you've done C2…

20. $y = x^4 - 14x^2 + 24x - 7$. $\boxed{(1, 4), (2,), (-3,)}$

21. $y = 6x^4 - 16x^3 - 3x^2 + 12x - 5$. $\boxed{\left(\frac{1}{2}, \right), \left(-\frac{1}{2}, \right), (2,)}$

22. $y = x^4 - 4x^2 + 4x + 1$. (I only need the x-coordinates here.) $\boxed{1, \frac{-1 \pm \sqrt{5}}{2}}$