

C1 Stationary Points

Find the stationary points on the following curves:

1. $y = x^2 + 2x + 3.$

$$(-1, 2)$$

2. $y = x^2 - 3x + 7.$

$$\left(\frac{3}{2}, \frac{19}{4}\right)$$

3. $y = 2x^2 + 3x + 5.$

$$\left(-\frac{3}{4}, \frac{31}{8}\right)$$

4. $y = 3x^2 - 2x + 1.$

$$\left(\frac{1}{3}, \frac{2}{3}\right)$$

5. $y = ax^2 + bx + c.$

$$\left(-\frac{b}{2a}, c - \frac{b^2}{4a}\right)$$

6. $y = 2x^3 + 3x^2 - 36x + 4.$

$$(2, -40) \text{ and } (-3, 85)$$

7. $y = 4x^3 - 27x^2 + 24x - 3.$

$$(4, -83) \text{ and } \left(\frac{1}{2}, \frac{11}{4}\right)$$

8. $y = 2x^3 + x^2 - 4x + 1.$

$$(-1, 4) \text{ and } \left(\frac{2}{3}, -\frac{17}{27}\right)$$

9. $y = -x^3 + 3x^2 + 9x - 1.$

$$(3, 26) \text{ and } (-1, -6)$$

10. $y = x^3 - 2x^2 - x + 1.$ (I only need the x -coordinates here, but in fully simplified surd form.)

$$x = \frac{2 \pm \sqrt{7}}{3}$$

11. $y = 4x^3 + 24x^2 + 45x - 10.$

$$\left(-\frac{3}{2}, \right) \text{ and } \left(-\frac{5}{2}, \right)$$

12. $y = 20x^3 + 39x^2 - 18x + 5.$

$$\left(\frac{1}{5}, \right) \text{ and } \left(-\frac{3}{2}, \right)$$

13. $y = 2x^3 - 3px^2 - 3qx^2 + 6pqx + p.$

$$(p,) \text{ and } (q,)$$

14. $y = 4x^3 + 3px^2 - 2qx^2 - 2pqx + 5.$

$$\left(-\frac{p}{2}, \right) \text{ and } \left(\frac{q}{2}, \right)$$

15. $y = ax^3 + bx^2 + cx + d.$ (I only need the x -coordinates here.)

$$x = \frac{-b \pm \sqrt{b^2 - 3ac}}{3a}$$

16. $y = 4x + \frac{9}{x}.$

$$\left(\frac{3}{2}, \right) \text{ and } \left(-\frac{3}{2}, \right)$$

17. $y = 4x^2 - \frac{1}{x} + 1.$

$$\left(\frac{1}{2}, 0\right)$$

18. $y = \sqrt{x} \left(\frac{2x^2}{5} - \frac{2x}{3} \right).$

$$(0, 0) \text{ and } \left(1, -\frac{4}{15}\right)$$

19. $y = \frac{2x\sqrt{x}}{21} (3x^2 - 7).$

$$(0, 0) \text{ and } \left(1, -\frac{8}{21}\right)$$

Only attempt the rest if you've done C2...

20. $y = x^4 - 14x^2 + 24x - 7.$

$$(1, 4), (2,), (-3,)$$

21. $y = 6x^4 - 16x^3 - 3x^2 + 12x - 5.$

$$\left(\frac{1}{2}, \right), \left(-\frac{1}{2}, \right), (2,)$$

22. $y = x^4 - 4x^2 + 4x + 1.$ (I only need the x -coordinates here.)

$$1, \frac{-1 \pm \sqrt{5}}{2}$$