<u>**Samples**</u>   **Differentiation SOLUTIONS**

1. Q1 $f'(x) = 3x^2 - 6x - 72$

    Q2 $f'(x) = 0$, so from Q1 , $3x^2 - 6x - 72 = 0$, so we use $a = 3, b = -6, c = -72$ in the quadratic formula. Hence

    $$\begin{aligned} x &= \frac{6 \pm \sqrt{(-6)^2 - 4 \times 3 \times (-72)}}{2 \times 3} \\ &= \frac{6 \pm \sqrt{36 - (-864)}}{6} \\ &= \frac{6 \pm \sqrt{900}}{6} \\ &= \frac{6 + 30}{6} \quad or \quad \frac{6 - 30}{6} \\ &= \frac{36}{6} \quad or \quad \frac{-24}{6} \\ &= 6 \quad or \quad -4 \end{aligned}$$

    Q3 $f''(x) = 6x - 6$

    Q4 $f'(-1) = 3 \times (-1)^2 - 6 \times (-1) - 72 = -63$

2. Q1 $f'(x) = -3x^2 - 12x - 12$

    Q2 $f'(x) = 0$, so from Q1 , $-3x^2 - 12x - 12 = 0$, so we use $a = -3, b = -12, c = -12$ in the quadratic formula. Hence

    $$\begin{aligned} x &= \frac{12 \pm \sqrt{(-12)^2 - 4 \times (-3) \times (-12)}}{2 \times (-3)} \\ &= \frac{12 \pm \sqrt{144 - 144}}{-6} \\ &= \frac{12 \pm \sqrt{0}}{-6} \\ &= \frac{12}{-6} \\ &= -2 \end{aligned}$$

    Q3 $f''(x) = -6x - 12$

    Q4 $f'(5) = -3 \times 5^2 - 12 \times 5 - 12 = -147$

3. Q1 $f'(x) = 3x^2 + 18x + 24$

    Q2 $f'(x) = 0$, so from Q1 , $3x^2 + 18x + 24 = 0$, so we use $a = 3, b = 18, c = 24$ in the quadratic formula. Hence

    $$\begin{aligned} x &= \frac{-18 \pm \sqrt{18^2 - 4 \times 3 \times 24}}{2 \times 3} \\ &= \frac{-18 \pm \sqrt{324 - 288}}{6} \\ &= \frac{-18 \pm \sqrt{36}}{6} \\ &= \frac{-18 + 6}{6} \quad or \quad \frac{-18 - 6}{6} \\ &= \frac{-12}{6} \quad or \quad \frac{-24}{6} \\ &= -2 \quad or \quad -4 \end{aligned}$$

    Q3 $f''(x) = 6x + 18$

    Q4 $f'(-6) = 3 \times (-6)^2 + 18 \times (-6) + 24 = 24$