Section 4: More about differentiation

Section test

1. Given that $y = x^3 + 2x^2 - 3x + 1$, find the value of $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$ when $x = -2$.

2. Given that $\mathrm{f}(x) = \frac{1}{x} - \sqrt{x}$, find the value of $\mathrm{f}''(x)$ when $x = 4$.

3. The point (a, b) is a local maximum if when $x = a$

(a) $\frac{\mathrm{d}y}{\mathrm{d}x} < 0$ and $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} > 0$

(b) $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$ and $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} > 0$

(c) $\frac{\mathrm{d}y}{\mathrm{d}x} > 0$ and $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} < 0$

(d) $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$ and $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} < 0$

4. Given that $y = 3x(1 - x^3)$, $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} =$

(a) $3 - 12x^3$

(b) $-36x^2$

(c) 0

(d) $-18x^2$

5. Given that $x + y = 60$, what is the maximum value of x^2y?
What is the value of x for this maximum value?

6. A straight wall AB and a fence of length 10 m form a rectangular enclosure. The width of the enclosure is x m.

Find an expression for the area of the enclosure, in m², in terms of x.
What is the maximum possible area of the enclosure?

7. A curve has equation $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = x^3 + x$.
The gradient of the chord joining $(1, 2)$ to $(1 + h, \mathrm{f}(1 + h))$ on the curve is

(a) $4 + h$

(b) $4 + 3h + h^2$

(c) $\frac{-1 + 3h + 3h^2 + h^3}{h}$

(d) $\frac{1 + 3h + 3h^2 + h^3}{h}$

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8. A curve has equation $y = \mathrm{f}(x)$, where $\mathrm{f}(x) = 5x^2$.

The gradient of the chord joining $\left(x, \mathrm{f}(x)\right)$ to $\left(x+h, \mathrm{f}(x+h)\right)$ on the curve is

(a) $10x + h$

(b) $\dfrac{5x^2 + 10hx + 5}{x + h}$

(c) $10x + 5h$

(d) $\dfrac{5x^2 + 10xh + 5h^2}{h}$