Geometrical applications of differentiation

Stationary points (1)

QUESTION **1**   Complete:

a   A stationary point is a point on $y = f(x)$ where the tangent is parallel to the _____

b   At a stationary point of the curve $\dfrac{dy}{dx} = $ _____

c   A turning point is either a _____ or a _____

QUESTION **2**   Determine whether the following statements are true or false:

a   All turning points are stationary points. _____

b   All stationary points are turning points. _____

QUESTION **3**   Choose the correct term from absolute maximum, absolute minimum, local maximum or local minimum:

a   The greatest value of a function over the given domain. _____

b   A maximum turning point. _____

c   A minimum turning point. _____

d   The least value of a function over the given domain. _____

QUESTION **4**   For what value(s) of x does $f'(x) = 0$?

a $f(x) = x^2 + 8x$ **b** $f(x) = x^6$ **c** $f(x) = x^3 - 3x^2 - 9x + 2$

_____   _____   _____

_____   _____   _____

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QUESTION **5**   Each curve has a stationary point at $x = 2$. True or false?

a $y = 3x^2 - 12x + 5$ **b** $y = x^5 + 2x^3 - 7x^2$ **c** $y = \dfrac{x^3}{3} - \dfrac{3x^2}{2} - 10x + 7$

_____   _____   _____

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Geometrical applications of differentiation

Stationary points (2)

QUESTION **1**   Find the stationary point of these curves:

a $y = x^2 + 6x - 4$

b $y = x^4 + 2$

c $y = 11 - 18x - 3x^2$

QUESTION **2**   Find all stationary points of the curve:

a $y = 2x^3 - 3x^2 - 12x + 7$

b $y = x^2 - x^3$

Geometrical applications of differentiation

Nature of stationary points (1)

QUESTION **1**   Complete:

a A stationary point of the curve $y = f(x)$ occurs when $f'(x) = $ _____

b If $f'(x) < 0$ immediately to the left of a stationary point and $f'(x) > 0$ immediately to the right of the stationary point, then the stationary point is a _____

c If $f'(x) > 0$ immediately to the left of a stationary point and $f'(x) < 0$ immediately to the right of the stationary point, then the stationary point is a _____

d If the derivative has the same sign either side of a stationary point, then the stationary point is a

_____

QUESTION **2**   Given that the curve has a stationary point at $x = 0$, determine its nature:
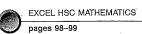
a $y = 3 - x^2$

b $y = x^3$

c $y = x^4$

QUESTION **3**   Determine the nature of the stationary point of the curve:

a $y = 7 - 2x - x^2$

b $y = (x + 2)^3$

c $y = \sqrt{9 - x^2}$

Geometrical applications of differentiation

Nature of stationary points (2)

QUESTION **1**   Find the stationary points of each curve and determine their nature:

a $y = 2x^3 - 15x^2 + 8$

b $y = \dfrac{1}{3}x^3 + x^2 - 8x + 2$

Page 3 **1** **a** x-axis **b** 0 **c** maximum, minimum **2** **a** true **b** false **3** **a** absolute maximum **b** local maximum **c** local minimum **d** absolute minimum **4** **a** $x = -4$ **b** $x = 0$ **c** $x = -1$ or $x = 3$ **5** **a** true **b** false **c** false

Page 4 **1** **a** $(-3, -13)$ **b** $(0, 2)$ **c** $(-3, 38)$ **2** **a** $(-1, 14)$ and $(2, -13)$ **b** $(0, 0)$ and $\left(\dfrac{2}{3}, \dfrac{4}{27}\right)$

Page 5 **1** **a** 0 **b** minimum **c** maximum **d** horizontal point of inflexion **2** **a** maximum **b** horizontal point of inflexion **c** minimum **3** **a** maximum (at $x = -1$) **b** horizontal point of inflexion (at $x = -2$) **c** maximum (at $x = 0$)

Page 6 **1** **a** maximum at $(0, 8)$, minimum at $(5, -117)$ **b** maximum at $\left(-4, 28\dfrac{2}{3}\right)$, minimum at $\left(2, -7\dfrac{1}{3}\right)$