

SHARP

Worksheet 11: Calculus Part 2

Grade 12 Mathematics

1. Find the first and second derivatives of the following functions:

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

b) $f(x) = 4x - 5$

c) $y = x^3 - 4x^2 + 8x - 7$

d) $y = \sqrt[3]{x} + \frac{1}{x^2}$

e) $f(x) = \frac{5}{x} - 11x^2$

f) $g(x) = \frac{x^2 - x}{x - 1}$

g) $y = x^5 + 7x^2 - 12$

h) $y = -x^3 + 4x^2 - 18x - 2$

i) $h(x) = \frac{4}{x^3} - \sqrt{x^3}$

j) $y = \frac{1}{3}x^3 + \frac{1}{4}x^2 - 3x + 2$

2. For each of the graphs given below, give the point of inflection, and determine the concavity of the graph.

a) $f(x) = x^3 - 5x^2 - 10x + 5$

b) $g(x) = -x^3 + x^2 - 3x + 7$

c) $h(x) = (x - 3)(x + 2)(x - 1)$

d) $j(x) = x^3 - 2$

e) $k(x) = -3x^3 + 12x^2$

f) $m(x) = x^2 - 3x + 12$

g) $n(x) = -(x - 1)(x - 2)(x - 4)$

h) $p(x) = -(x^2 - 8)(x + 3)$

i) $q(x) = 4x^3 - 6x^2 - 3x + 5$

j) $r(x) = 5x^3 + 3x^2 - 4x + 12$

3. For each of the following functions:

i) Find the x- and y-intercepts

ii) Find the turning or stationary points

iii) Find the point of inflection.

iv) Plot the graph on a Cartesian plane.



- a) $y = x^3 + 7x^2 + 7x - 15$ b) $y = x^3 + 13x^2 + 34x - 48$
 c) $y = 3x^3 - 13x^2 - 130x + 336$ d) $y = -x^3 + 6x^2 + 45x - 162$
 e) $y = 3x^3 - 29x^2 + 17x + 9$ f) $y = -3x^3 + 20x^2 + 69x - 54$
 g) $y = 5x^3 - 39x^2 + 78x - 40$ h) $y = -x^3 + 6x^2 + 67x - 360$
 i) $y = 6x^3 + 7x^2 - 84x - 160$ j) $y = -x^3 - 7x^2 + 84x + 288$

4. The speed of a molecule osmosing through the membrane of a cell is given by the following equation:

$$v(t) = \frac{1}{3}t^3 - 3t + 6t$$

- a) Find the points where the molecule cannot get through the cell wall.
 b) Find the point where the molecule reaches a maximum speed of osmosis.
5. A box that has a square base, has a volume of 3 liters. Find the maximum surface area of the box.
6. A rectangular plot of land has length x , and width y . The perimeter of the plot is 300m.
- a) Write down a formula for y on its own.
 b) Find the maximum area of the plot.
 c) The plot's width is extended by 40m. Write a new formula to find y on its own.
 d) Find the maximum area of the plot after this extension.

