

Derivatives test

Maths 3b/3c

The questions marked as “bonus questions” are optional and will count if they are correct but not if they are wrong or unanswered.

Name: _____

1. Given the function $f(x) = -0.5x^2 + x + 2$

a) Calculate the rate of change of the function between $x=1$ and $x=3$ (2/0/0)

b) Calculate the rate of change of the same function between $x=1$ and $x=1.5$ (2/0/0)

c) Which of the previous calculations is closest to the value of the derivative of $f(x)$ at $x=1$?
Explain your answer (0/2/0)

2. The income for a given company in any year t (after 2010) is described by the function $i(t) = 20 \cdot 1.1^t$

a) Calculate the income increase between 2010 and 2011. (2/0/0)

b) Calculate average income increase per year (rate of change) between 2010 and 2012. (2/0/0)

3. The temperature in a greenhouse is given by the function $g(t)$ where t is the time in hours. State what these expressions mean.

a) $g(0) = 6$ (1/0/0)

b) $g(5) = 14$ (1/0/0)

c) $g'(5) = 0.6$ (2/0/0)

d) $g'(9) = -0.4$ (2/0/0)

4. Use the definition of the derivative to calculate the derivative function of these functions.

a) $h(x) = -2x + 4$ (0/1/1)

b) $j(x) = kx + m$ (0/1/2)

5. Differentiate the following functions (find their derivative function):

a) (0/2/0)

$$k(x) = x^4 + 4x^3 + 7x^2 + 3x + 60$$

b) (0/1/1)

$$l(x) = x^3 + \frac{1}{x^2}$$

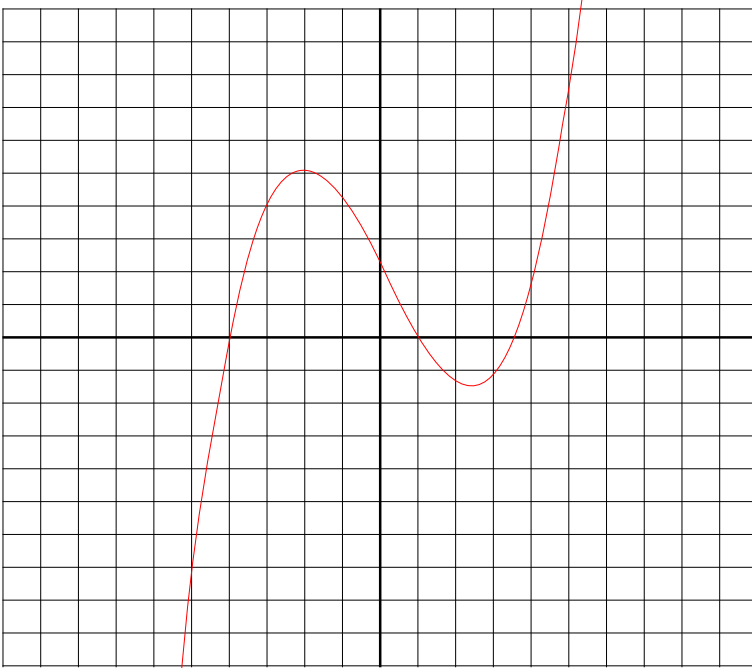
c) (0/1/1)

$$m(x) = \frac{1}{\sqrt[3]{x^2}}$$

d) Bonus (0/1/1)

$$o(x) = \sin(x^2)$$

6. Given this function



- a) Find a point (mark it with an A) where the function is positive and the derivative negative. (1/0/0)
- b) Find a point (mark it with a B) where both the function and the derivative are negative. (1/0/0)
- c) Find a point (mark it with a C) where the function is negative and the derivative positive. (1/0/0)
- d) Is there any point where the derivative is zero? (if so, mark it) (0/1/0)
- e) Bonus: Find a point where the function is negative and the derivative is also negative but increasing (0/1/0)

7. The deficit in a given country has shown to fit the function $p(x) = x^3 - 2x^2 + 0.4x + 1$ where x is the time in years starting now and the deficit is in billions of euros.

- a) Is the deficit increasing now? Explain your answer. (1/1/0)

b) After one year, the deficit is checked again (it still follows the same function). Is it higher? Is it increasing? explain your answers (2/2/0)

c) Find the equation of the tangent line for the deficit when one year has passed ($x=1$) (1/2/0)

d) If the deficit goes on progressing as in section 2, when will it reach 0? (1/1/0)

e) When one and a half years have passed, they find that the deficit is increasing. If it continues to increase at that rate, when will it reach the country's GDP (which is 2 billions) ?(0/2/1)