Derivatives test

Maths 3c

Non-calculator section

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. Define

   a) The rate of change of a function between two points: (1/0/0)

   b) The derivative of a function in a point:(1/0/0)

2. Bonus question: say if the following statement is true or false and provide justification.
   "Let $b(x)$ be a function, if $b(2) = 3$ and $b(5) = -1$, then there must be at least one value of x (call it x_0) between 2 and 5 for which $f(x_0)$ is 0"

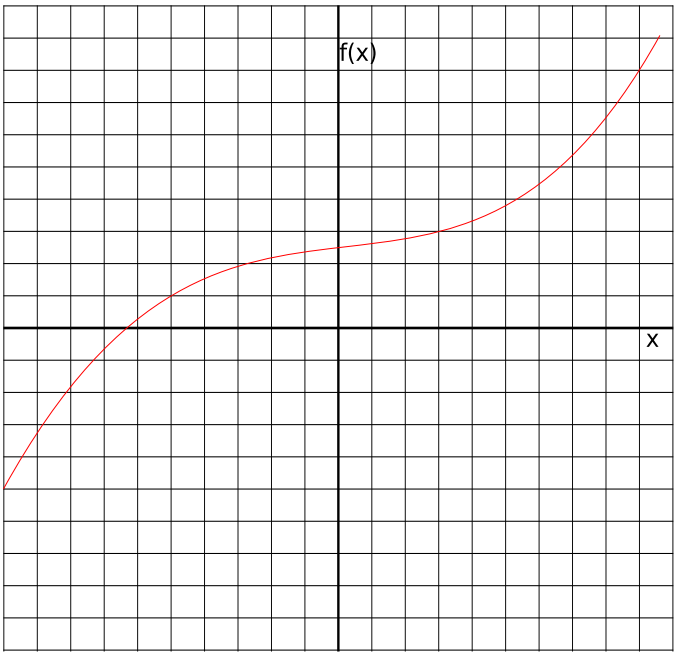
3. Given this information about these functions:

a) $g(x) = 0{,}1x^3 + x^2 + 2x + 2$

b) h(x):

x	h(x)
-1	3
0	1
1	0
2	3
3	2

c) f(x):



d) Calculate the rate of change of g(x) between -3 and 2 . (1/0/0)

e) Calculate the rate of change of h(x) between -1 and 3 . (1/0/0)

f) Calculate the rate of change of f(x) between -5 and 9 . (1/0/0)

4. Choose the correct answer. (1/0/0)
   We calculate the rate of change of a function between two values of x: 3 and 6. If the result of this calculation turns out to be -3, that means:

   a) The function decreases through the interval between 3 and 6.

   b) The slope of the straight line that passes through those two points of the function is -3.

   c) The slope of the function in x=3 is negative.

   d) The slope of the function in x=6 is negative.

5. Use the definition of the derivative to derive:

   a) $i(x) = x^2 + 4x + 3$ (0/2/0)

   b) $j(x) = x^n$ (n is a natural number) (0/0/2)

6. Explain the definition of derivative. The explanation must include its connection with the rate of change and the fact that in is a limit. (2/2/0)

7. Derive:

a) (0/1/0)

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

b) (0/1/0)

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

c) (0/1/0)

$$q(x) = (2x^2 + 3x) \cdot \sin x$$

d) (0/1/0)

$$r(x) = \frac{x^3 - 3x^2 + 2x}{\sqrt{x}}$$

e) (0/1/0)

$$s(x) = \cos^3 x$$

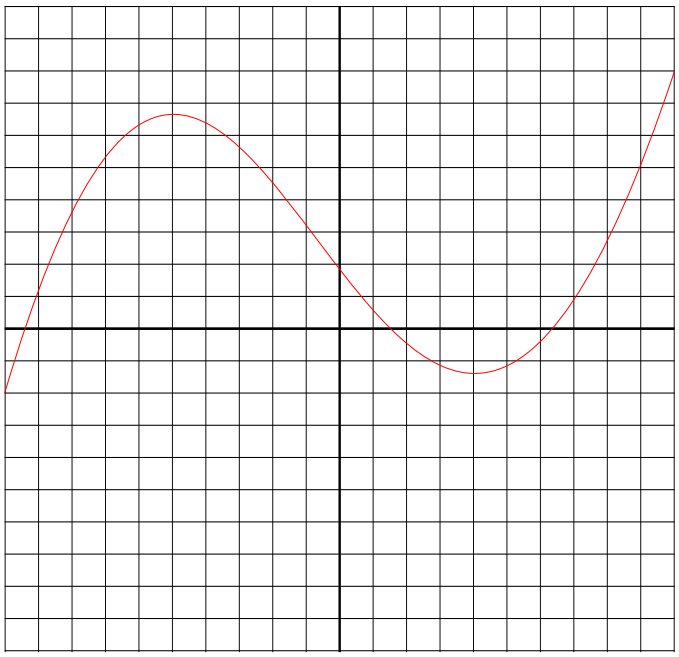
f) (1/0/0)

$$t(x) = 12^x$$

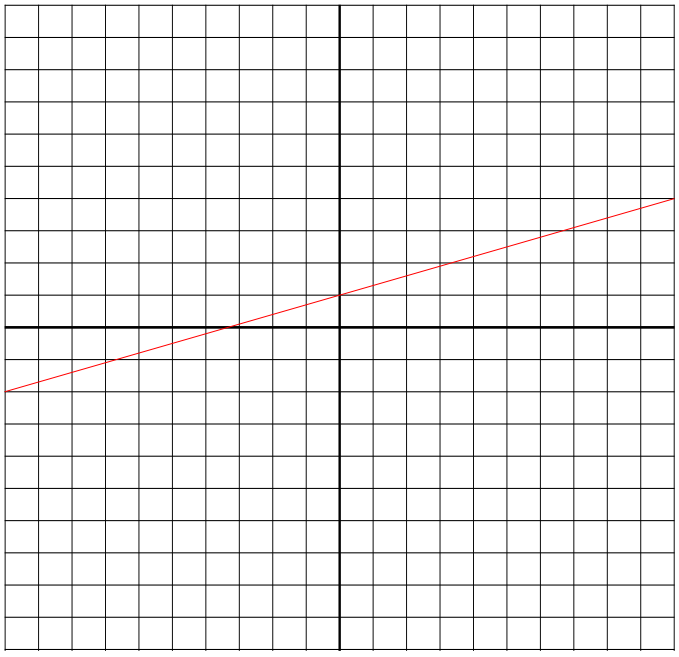
g) Bonus (0/1/0):

$$u(x) = \sqrt{4x^{log_x 4}}$$

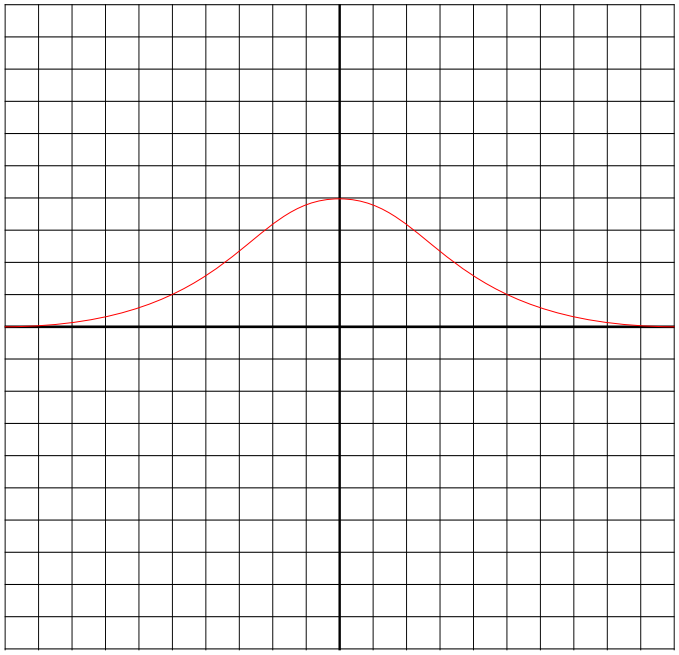
8. In the following graph, draw approximately the derivative of the plotted function.(0/0/1)



9. The following graph represents the derivative of an unknown function. Draw approximately that function based on the derivative.(0/0/1)



10. Bonus question: the following graph represents the derivative of an unknown function. Draw approximately that function based on the derivative.(0/0/1)



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Maths 3c

Calculator section

11. The starship [insert humorous name here] is moving through space in a straight line. The position is dependent on time according to the following function (time t is measured in seconds):

    $p(t) = 0{,}4t^2 + 820t + 3600$

    Answer the following questions:

    a) What is the position of the ship at the beginning? (1/0/0)

    b) What is the speed of the ship at the beginning? (1/0/0)

    c) What is the position of the ship after 12 seconds? (1/0/0)

    d) What is the speed of the ship after 30 seconds? (0/1/0)

e) What is the acceleration of the ship at the beginning? (0/1/0)

f) What is the acceleration of the ship after twelve nanoseconds? (0/0/1)

12. Given the function

$$v(x) = \frac{1}{2}x^3 + 4x^2 + 6x + 2$$

a) Calculate the slope in -5 (1/0/0)

b) Calculate the slope in 1 (1/0/0)

c) Bonus: find the value of x for which the curvature passes from positive to negative or from negative to positive (0/0/1)