

1. (14 points) The quarterback is in the middle of the field on the 50 yard line. A wide receiver is running on the 40 yard line directly towards the sidelines. If the receiver is running at a speed of 10 yards per second, how fast is the distance between the quarterback and the receiver increasing when the receiver is 10 yards from the middle of the field?

2. (10 points)

a) What is the definition of the derivative $f'(x)$?

b) Use the definition of derivative to calculate $f'(x)$ when $f(x) = 4x + 3$.

3. (12 points) Differentiate the following

a)

$$f(x) = \sin(e^{2x} + x)$$

b)

$$g(x) = (x^2 + 1)^4(x^3 + 1)^3$$

c)

$$h(x) = \frac{x^2 + 1}{\cos(x)}$$

4. (10 points) Find the equation of the tangent line at the point $(1, 0)$ to the curve

$$x^3 + x^3 \sin(y) = y^3 + 1$$

5. (16 points) Differentiate the following:

a)

$$f(x) = \ln(x^3 + 1)^{\frac{1}{3}}$$

b)

$$g(x) = \log_4(\sin(x))$$

c)

$$h(x) = \tan^{-1}(2x + 1)$$

d)

$$k(x) = 2^{(x^2+1)}$$

6. (10 points) Find $\frac{dy}{dx}$ if $y = x^{(2x^3)}$.

7. (14 points) The position of a particle on a line is given by the formula

$$s(t) = 2t^3 - 3t^2 + 1.$$

a) When is the velocity positive?

b) When is the acceleration positive?

8. (14 points) If $f(x) = \sin(2x)$ find $f^{(38)}(x)$.