

**Question 1:**

(a)[7 points] Use the limit definition of the derivative to find  $f'(x)$  if  $f(x) = \frac{2x}{x+1}$ .

(b)[3 points] Now use your derivative rules to check your answer in part (a).

**Question 2:**

(a)[3 points] Let  $f(x) = 5x^3 - 7x + 11$ . Find  $f'(x)$ .

(b)[3 points] Find  $\frac{dy}{dx}$  if  $y = 2\sqrt{x} \cos x$ .

(c)[4 points] Let  $g(t) = \frac{1 + \sin t}{t + \cos t}$ . Find  $g'(0)$ .

**Question 3:**

(a)[3 points] Find  $f'(x)$  if  $f(x) = \sqrt[3]{1 + \tan x}$ .

(b)[3 points] Find  $\frac{dy}{dx}$  if  $y = \sin \sqrt{2 - x^2}$ .

(c)[4 points] Find  $f''(1)$  if  $f(t) = \sqrt{8t^2 + 1}$ .

**Question 4:**

(a)[5 points] Find the equation of the tangent line to the curve

$$y^2(y^2 - 4) = x^2(x^2 - 5)$$

at the point  $(0, -2)$ .

(b)[5 points] A particle moving in a straight line has position  $s(t)$  metres after  $t$  seconds, where  $s(t) = 6t^3 - 3t^2 + k$  where  $k$  is some positive constant. At what time(s) is the particle's acceleration zero?

**Question 5 [10 points]** A person is walking at 2 metres per second toward the bottom of a pole 12 metres in height. How fast is the distance between the person and the top of the pole changing when the person is 5 metres from the bottom of the pole? State units with your answer.