

Problem Sheet 1 for 6401

Due Thursday 13 Oct 2011, at the Problem Class. You should hand in solutions to all problems, but only some of them will be marked. The deadline for handing in your work is 11.55 am.

1. Use the definition of derivative to find $f'(x)$ (you are not allowed to use any rules for differentiating established in the course!):

(a) $f(x) = 17$;

(b) $f(x) = -6x + \pi$;

(c) $f(x) = 15 - 3x + 4x^2$;

(d) $f(x) = \frac{1}{x+3}$;

(e) $f(x) = \sqrt{2x+3}$;

(f) $f(x) = \frac{3}{\sqrt{x}}$;

(g) $f(x) = 3x^3 - 4x$.

2. Differentiate the following functions, using whichever rules for differentiating you find necessary:

(a) $f(x) = \frac{3x}{4x^2+3}$;

(b) $f(x) = (x+1)(x^2+2)(x^3+3)$;

(c) $f(x) = \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{x}}}}$;

(d) $f(x) = \frac{4x^3 + \sin(x + \sqrt{x})}{e^{\cos x} - x^{1/3}}$.

3. For $f(t) = 3t^2 + 2t$, the position of a point P on a coordinate line is given by $f(t)$, where t is measured in seconds and $f(t)$ in centimeters.

(a) Find the average velocity of P in the following time intervals: $[1, 1.2]$; $[1, 1.1]$; $[1, 1.01]$; $[1, 1.001]$.

(b) Find the velocity of P at $t = 1$;

(c) Determine the time intervals in which P moves in the positive direction;

(d) Determine the time intervals in which P moves in the negative direction.