

**EE106 – Engineering Mathematics I**

**Problem Set 4**

Due by 5pm on Friday, 26 October 2018

1. Find the derivatives of the following functions:

(a)  $[\cosh(x)]^2 - [\sinh(x)]^2$

(b)  $\exp[e^{-\sin(x)}]$

(c)  $3 \exp\left[\ln\left(\frac{1}{x^2}\right)\right]$

(Recall that  $\exp(x)$  is the same as  $e^x$ .)

2. If  $f(x) = \operatorname{arccot}(x)$ , then  $f$  satisfies

$$\cot(f(x)) = x.$$

Use this to show that

$$\frac{d}{dx} \operatorname{arccot}(x) = -\frac{1}{1+x^2}$$

Remember that  $\cot(x) = \cos(x)/\sin(x)$  and that  $(\cos(x))^2 + (\sin(x))^2 = 1$ .

3. An alternating voltage is described by the function

$$V(t) = -V_0 [\sin(\omega t)]^2$$

where  $V_0$  and  $\omega$  are positive constants. Determine the maximum and minimum values of this voltage.

4. Find all the critical points of the following functions, and identify them as maxima, minima or neither. Then determine if they have any points of inflection and, if so, where they occur.

(a)  $f(x) = x^3 - 18x^2 + 10$

(b)  $f(x) = \frac{3x}{x^2 + 2}$

(c)  $f(x) = x^5$

(d)  $f(x) = e^{-x^2}$