

First Name: _____ Last Name: _____

Student-No: _____ Section: _____

1. 3 marks Differentiate the function $f(x) = (\arcsin x)^{\arccos x}$. Assume $0 < x < 1$.

2. $f(x) = \arctan x$ is the inverse of function $g(x) = \tan x$.

- (a) 2 marks Using properties of inverse functions, show that

$$\frac{d}{dx}(\arctan x) = \frac{1}{1+x^2}.$$

You may need to use this identity $\sec^2 x = 1 + \tan^2 x$.

- (b) 1 mark Find the derivative of

$$k(x) = 2^{\arctan x}$$

3. A hot air balloon is attached to a spool of rope that is 40 meters away from the balloon when it is on the ground. The hot air balloon rises straight up in such a way that the length of rope increases at a rate of 5 meters/sec.
- (a) 4 marks How fast is the balloon rising when the length of rope is $50m$. Do not forget to write its unit. Sketch a graph that explains the problem.
- (b) bonus 2 marks What is the rate at which the angle that the rope makes with the ground changes? You may need to use results of problem 2.