Worksheet 07/09 Calculus I Summer B 2018 **Group nr:** ______________

1. For each of the following implicitly defined functions, find $\frac{dy}{dx}$:

(a) $y^4 - 3x^2y^3 - x = 3$

(b) $\cos(xy) = x - y$

2. Consider the function implicitly defined by $y^4 = x + y$.

a) Find an expression for the derivative $\frac{dy}{dx}$.

b) Find the equation of the line tangent to this function at the point (0,1).

c) Find where the tangent line is vertical.

3. Find, with proof, the formulae for $(\arctan(x))'$ and $(\text{arccot(x)})'$.

4. Compute the derivative of each of the following functions:

a) $y = \arctan(\sin(x))$

b) $y = \cos(x)\tan^{-1}(2x)$

c) $y = \sin^{-1}(\cos(3x))$

d) $y = \frac{x^3+7}{\arctan(x^2)}$

5. Show that the function $f(x) = 2x^3 + 6x - 5$ is one to one and then find $(f^{-1}(3))'$. Note that $f(1) = 3$.

6. A ten-foot long, straight plank is leaning against a vertical wall when it begins to slip. Suppose the base of the plank is moving away from the wall at 2ft./s.. How fast is the top of the plank moving down the wall when the top is 6ft above the ground?

7. Two cars start moving from the same point, at the same time. One travels south at 60 mi/h and the other travels west at 40 mi/h.

(a) At what rate is the distance between the cars changing two hours later?

(b) Is the distance between the two cars changing at the same rate at all times? Justify your answer.

8. A telescope on the ground is tracking a rocket which is rising vertically from a launchpad. The telescope is 5 kilometers from the launchpad and denote by θ the angle with respect to which the telescope observes the rocket above the ground. Suppose that at the moment when the rocket is 10km above the ground, the angle θ is increasing at a rate of one degree per second. What is the vertical speed of the rocket at that moment?

9. A conical water tank with vertex down has a radius of 12 ft at the top and is 30 ft high. If the water flows into the tank at a constant rate of 20 ft^3/min, how fast is the depth of the water increasing when the water is 6 ft deep?