Faculty of Science
Department of Mathematics and Statistics

Calculus I   Fall 2009
Worksheet 9
[Applications]

1.   Water is withdrawn from a conical reservoir (vertex down). The reservoir is12 metres in
        diameter and is 15 metres deep. If the water is withdrawn at the constant rate of 7.5 cubic
        metres per minute, how fast is the level of the water falling when the water is 9 metres
        deep?

2.   Water flows in a river which travels from east to west at the rate of 8km./hour. The river
        is 5 km. wide and a canoeist needs to cross the river from the south side of the river to a
        point on the other bank directly north of his starting point. He can row in still water at the
        rate of 6 km/hour. Determine the direction in which he must travel in order to reach the
        required point.

3.   Two sides of a triangle have lengths 12 m. and 15 m. The angle, θ , between them
        increases at the rate of $2°$ per minute. How fast is the length of the third side changing
        when $\theta = 60°$.

4.   A lighthouse is located on a small island 3 km. Away from the nearest point P on a
        straight shoreline and its light makes four revolutions per minute. How fast is the beam
        of light moving along the shoreline when it is 1 km. From P?

5.   A trough is 10 metres long and its ends have the shape of isosceles triangles that are 3
        metres across the top and have a height of 1 metre. The trough is being filled at the rate
        of 12 cubic metres per minute.   How fast is the water level rising when the water is just
        0.5 metes deep?

6.   A policeman is standing near a highway using a radar gun to catch speeders. He aims the
        gun at a car that has just passed his position and, when the gun is pointing at an angle of
        45 degrees to the direction of the highway, notes that the distance between the car and the
        gun is increasing at a rate of 100 km/hour. How fast is the car travelling?

7.   A man walks along a straight path at a speed of 1.2 m/sec. A searchlight is located on the
        ground 6 metres from the path and is kept focussed on the man. At what rate is the

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searchlight rotating when the man is 4.5 metres from the point on the path closest to the searchlight?

8.   Sawdust is falling onto a pile at 0.5 *metres*^{3}/min.   If the pile maintains the shape of a right circular cone with height equal to its diameter, how fast is the height of the pile increasing when the pile is 3 metres high?

9.   A rectangular swimming pool is 8 metres wide and 20 metres long. Its bottom is a sloping plane, the depth increasing from 1 metre at the shallow end to 3 metres at the deep end. Water is draining out of the pool at 1 *metres*^{3}/min.   How fast is the surface of the water falling when the depth of water at the deep end is (a) 2.5 metres; (b) 1 metre ?

10.   A triangle has two sides of fixed length. One of the sides is 4 metres long and the other is of length 5 metres long.   The angle between these sides is increasing at the rate of 0.6 *radians*/sec.   Determine the rate of change of the area of the triangle at the instant when the angle contained by the two fixed sides is $\dfrac{\pi}{3}$ *radians*.

Please attempt question 8 to be handed in on Friday, October 23, 2009.