Worksheet 07/10 Calculus I Summer B 2017 **Group nr:** ______________

1. 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.

2. 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?

3. 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?

4. (a) Sketch the curve $x = 2\sin t, y = 5\cos t$, $0 \le t \le 2\pi$, by eliminating the parameter and indicate the direction of increasing t.

(b) Find the point(s) on the curve in part (a) where the tangent line to the curve is parallel to the line $y = x$.

5. A plane traveling horizontally at 80 m/s over flat ground at an elevation of 3000 m releases an emergency packet. The trajectory of the packet is given by

$$x = 80t, \quad y = -4.9t^2 + 3000, \quad \text{for } t \ge 0,$$

where the origin is the point on the ground directly beneath the plane at the moment of the release, and t is the time in seconds since the moment of release.

(a) Graph the trajectory of the packet and find the coordinates of the point where the packet lands.

(b) Find dx/dt, dy/dt, explain their practical meaning and why the formulas you got for each of them makes sense.

(c) Find the angle at which the released package hits the ground.

6. The flight of a bee follows the parametric curve $x = t - \cos t$, $y = 3 - 2\sin t$, where $0 \le t \le 4\pi$ is the time in seconds. Use the command – plot($x = t - \cos t$, $y = 3 - 2\sin t$) – to draw this curve in wolframalpha. Be careful that the horizontal line drawn by the program is **not** the x-axis, but is actually the line $y = 1$.

(a) At what times is the bee flying horizontally? Find the (x, y) coordinates of the corresponding points.

(b) At what times is the bee flying vertically? Find the (x, y) coordinates of the corresponding points.