

MATH 110 Problem Set 2.8

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The following problems based on Section 2.8 of the textbook will help you study. *You do not need to hand in solutions to these problems.*

1. (Based on 2.8.10) If $x^2 + y^2 = 25$ and $dy/dt = 6$, find dx/dt when $y = 4$.
2. (Based on 2.8.11) If $z^2 = x^2 + y^2$, $dx/dt = 2$, and $dy/dt = 3$, find dz/dt when $x = 5$ and $y = 12$.
3. (Based on 2.8.6) The radius of a sphere is increasing at a rate of 4 mm/s. How fast is the volume increasing when the radius is 40 mm?
4. (Based on 2.8.14) If a snowball melts so that its surface area decreases at a rate of $1 \text{ cm}^2/\text{min}$, find the rate at which the diameter decreases when the diameter is 10 cm.
5. (Based on 2.8.16) At noon, ship A is 150 km west of ship B. Ship A is sailing east at 35 km/h and ship B is sailing north at 25 km/h. How fast is the distance between the ships changing at 4:00 pm?
6. (Based on 2.8.25) Water is leaking out of an inverted conical tank at a rate of $10,000 \text{ cm}^3/\text{min}$ at the same time that water is being pumped into the tank at a constant rate. The tank has height 6 m and the diameter at the top is 4 m. If the water level is rising at a rate of 20 cm/min when the height of the water is 2 m, find the rate at which water is being pumped into the tank.
7. (Based on 2.8.39) If two resistors R_1 and R_2 are connected in parallel, as in Figure 1, then the total resistance R , measured in ohms (Ω), is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

If R_1 and R_2 are increasing at rates of $0.3 \Omega/\text{s}$ and $0.2 \Omega/\text{s}$ respectively, how fast is R changing when $R_1 = 80 \Omega$ and $R_2 = 100 \Omega$?

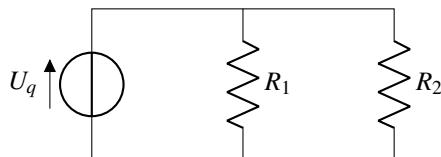


Figure 1: Electrical circuit for problem 7

8. (Based on 2.8.44) A lighthouse is located on a small island 3 km away from the nearest point P on a straight shoreline. The light in the lighthouse makes four revolutions per minute. How fast is the beam of light moving along the shoreline when it is shining on a point Q on the shoreline which is 1 km from P ?

You may find the following additional exercises from Section 2.8 helpful.

- 2.8 C-level: 1–35;
B-level: 36–40;
A-level: 41–50