NCEA Level 3 Calculus (Differentiation) 11. Related Rates of Change (Homework)

Reading

Problem-Solving Strategy

- 1. Read the problem carefully.
- 2. Identify the quantities given in the problem.
- 3. Identify the unknown quantity.
- 4. Draw a diagram and assign symbols to all quantities.
- 5. Write an equation relative the various quantities together (if necessary, using substitution to eliminate unwanted variables).
- 6. Use the chain rule to differentiate and solve for the unknown.

Questions

- 1. If V is the volume of a cube with edge length x and the cube expands as time passes, find $\frac{dV}{dt}$ in terms of $\frac{dx}{dt}$.
- 2. A water tank has the shape of an inverted circular cone with base radius $2 \,\mathrm{m}$ and height $4 \,\mathrm{m}$. If water is being pumped into the tank at a rate of $2 \,\mathrm{m}^3 \,\mathrm{min}^{-1}$, find the rate at which the water level is rising when the water is $3 \,\mathrm{m}$ deep.
- 3. A boat is pulled into a dock by a rope attached to the bow of the boad and passing through a pulley on the dock that is 1 m higher than the bow of the boat. If the rope is pulled in at a rate of $1 \,\mathrm{m\,s^{-1}}$, how fast is the boat approaching the dock when it is $8 \,\mathrm{m}$ from the dock?