

NCEA Level 3 Calculus (Differentiation)

9. Related Rates (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 m and height 4 m. If water is being pumped into the tank at a rate of $2 \text{ m}^3 \text{ min}^{-1}$, find the rate at which the water level is rising when the water is 3 m deep.
3. A boat is pulled into a dock by a rope attached to the bow of the boat 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 m s^{-1} , how fast is the boat approaching the dock when it is 8 m from the dock?