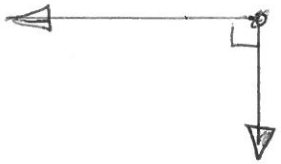
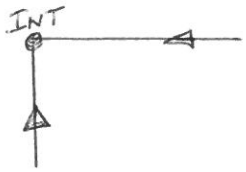
Applied Differentiation.

1. Two boats start moving from the same point. One travels south at $60km/hr$ and the other travels west at $25km/hr$. At what rate is the distance between the boats increasing two hours later.

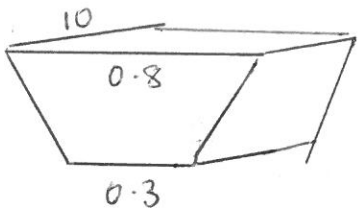


2. Car A is travelling west at $50\ km/hr$ and car B is travelling north at $60\ km/hr$. Both cars are heading for the intersection of the two roads. At what rate are the cars approaching each other when car A is $3km$ and car B is $4\ km$ from the intersection.



3. The altitude of a triangle is increasing at a rate of $1\ cm/min$ while the area of the triangle is increasing at a rate of $2cm^2/min$. At what rate is the base of the triangle changing when the altitude is $10\ cm$ and the area is $100\ cm^2$.

4. A water trough is $10\ m$ long and a cross-section has the shape of an isosceles trapezoid that is 30cm wide at the bottom, $80cm$ wide at the top, and has height $50cm$. If the trough is being filled with water at the rate of $0.2m^3/min$, how fast is the water level rising when the water is $30\ cm$ deep.



5. Boyle's Law states that when a sample of gas is compressed at a constant temperature, the pressure P and volume V satisfy the equation $PV = C$ where C is a constant. Suppose that at a certain instant the volume is $600\ cm^3$, the pressure is $150\ kPa$ and the pressure is increasing at a rate of $20\ kPa/min$. At what rate is the volume changing at this instant.

6. A man launches his boat from point A on a bank of a straight river, $3km$ wide, and wants to reach point B, $8\ km$ downstream on the opposite bank, as quickly as possible. He could row his boat directly across the river to point C and then run to B, or he could row to point D between C and B and then run to B. If can row $6km/hr$ and run $8km/hr$, where should he land to reach B as soon as possible? (Assume that other factors are negligible).