

Handout 1.2: Modeling with Pre-calculus

- Recent studies indicate that the average surface temperature of the earth has been rising steadily. Some scientists have modeled the temperature by the linear function $T=0.02t+8.50$, where T is the temperature in $^{\circ}\text{C}$ and t represents years since 1900.
 - Find $T(110)$ and explain its meaning.
 - What do the slope and T -intercept represent?
- A store wants to set the price of its 42-inch TVs at x dollars. At a price of x , they expect to sell $N(x)$ TVs monthly.
 - What does $N(300)=242$ mean?
 - Circle the inequality you expect to be true $N(375) > 242$ or $N(475) < 242$. Justify briefly.
- Assume C represents the monthly cost (in dollars) of cooling a building, as function of the average temperature, T , at noon. What does $C(92)=750$ mean? Should $C(98)$ exceed 750? Why/why not?
- A company operates 16 oil wells in a designated area. Each pump, on average, extracts 240 barrels of oil daily. The company can add more wells but every added well reduces the average daily output of each of the wells by 10 barrels.
 - Of the following expansions of operations, which would benefit the company the most (by increasing daily production the most): change nothing, add one well, add three wells, add six wells?
 - If the company adds x wells, give a formula for the daily production P , as a function of x .
 - Find x in order to maximize daily production P .
- An oil refinery is located on the north bank of a straight river that is 2 km wide. A pipeline is to be constructed from the refinery to storage tanks located on the south bank of the river 6 km east of the refinery. The pipe starts over land to a point P on the north bank, 5 km away from the refinery, and connects under the river to the storage tanks. The cost of laying pipe is \$400,000/km over land and \$800,000/km under the river.
 - Make a sketch illustrating the river, the pipe and their dimensions. How long is the pipe?
 - What is the cost of the pipe?
 - Assume that the pipe goes x km on land on the northern shore, then underwater to the refinery. Give a formula for the cost of the pipe as a function of x .
- An engineering firm needs to attach a circular tube (a cylinder) of volume 3142 m^3 to an existing underwater structure by welding one rim of the tube and welding along the length of tube, as shown below. Due to the hazards and cost of underwater welding, the company wants to minimize the overall length of the weld, W .



Cylinder



weld: rim and side

- Find a formula for the length of the weld, W , as a function of the radius of the cylinder.
- The circular tubes are only manufactured with radii of 6m, 6.5m, 7m, 7.5m, etc. The tubes can be cut to accommodate any desired length. Use graphing software to find the dimensions of the tube that should be used to minimize W .