Foundations Math Worksheet

1. Compare the actual bearing pressure that the shallow foundation produces and the allowable bearing pressure of the soil. Does the foundation fail? Why is $\sigma zD$ equal to 0? Show all your work and calculations.

**Actual bearing pressure** is $q = \frac{\text{force}}{\text{area}}$

The force, $P$, on the foundation is 100,000 lbs

The area of the bottom of the foundation is square with 10-foot sides

**Allowable bearing pressure** of the soil is $q_{ult} = 6.28 \times s_u + \sigma zD$

From soil investigations, $s_u = 500$ lbs/ft$^2$ and $\sigma zD$ is 0.
2. Compare the *actual* bearing pressure that the shallow foundation produces and the *allowable* bearing pressure of the soil. Does the foundation fail? Show all your work and calculations.

**Actual bearing pressure** is \( q = \text{force} / \text{area} \)

The force, \( P \), on the foundation is 200,000 lbs

The area of the bottom of the foundation is square with 7-foot sides

**Allowable bearing pressure** of the soil is \( q_{\text{ult}} = 6.28 \times s_u + \sigma_{zD} \)

From soil investigations, \( s_u = 500 \text{ lbs/ft}^2 \) and \( \sigma_{zD} \) is 110 lbs/ft\(^2\)
3. Compare the actual load given for the deep foundation and the allowable ultimate load calculated. Does the foundation fail? Show all your work and calculations.

The actual load, \( P \), on the foundation is 100,000 lbs.

The allowable load \( P_a = q_t' \times A_t + f_s \times A_s \).

The area of the bottom of the foundation is circular with a 1-foot radius.

Area of a circle = \( \pi \times \text{radius} \times \text{radius} \)

The area of the side of the foundation is the surface area of the foundation in contact with the soil. The area is the foundation circumference of the multiplied by the foundation length.

Circumference = \( 2 \times \pi \times \text{radius} \)

\( \pi = 3.14 \)

Length of the foundation = 40 feet

From soil investigations, \( q_t' = 3000 \text{ lbs/ft}^2 \) and \( f_s = 600 \text{ lbs/ft}^2 \)