**Strength of Materials Math Worksheet Answers**

1. **Calculate the maximum tensile and compressive forces allowed for the cross-sectional area shown in Figure 1. The maximum tensile strength is 500 lb/ (pounds per inches squared). The maximum compressive strength is 5,000 lb/. Use the following equations to complete the problem. Show your work and calculations.**

cross-sectional area = (B) x (L)

maximum tensile force = (maximum tensile strength) x (cross-sectional area)

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Description automatically generatedmaximum compressive force = (maximum compressive strength) x (cross-sectional area)

**Answer**:

Cross-sectional area = (10 inches) x (20 inches) = 200

Maximum tensile force = (500 lb/) x (200 ) = 100,000 lb

Maximum compressive force = (5,000 lb/) x (200 ) = 1,000,000 lbs

**Figure 1: Cross-sectional area.**

1. **Calculate the maximum tensile and compressive forces allowed for the following two cross-sectional areas shown in Figure 2. The maximum tensile strength is 3,750 lb/. The maximum compressive strength is 4,850 lb/. Use the following equations along with those in #2 to complete the problem. Show your work and calculations.**

cross-sectional area =

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**Answer**:

Cross-sectional area of circle = 3.14 x = 314

Cross-sectional area of I-beam = (15 inches) x (2 inches) + (15 inches) x (2 inches) + (2 inches) x (20 inches) = 100

Maximum tensile force of circle = (3,750 lb/) \* (314 ) = 1,177,500 lb

Maximum compressive force of circle = (4,850 lb/) \* (314 ) = 1,522,900 lb

**Figure 2: Cross-sectional areas.** Maximum tensile force of I-beam = (3,750 lb/) x (100 ) = 375,000 lb

Maximum compressive force of I-beam = (4,850 lb/) x (100 ) = 485,000 lb

1. **Part 1: Calculate the compressive force for the cross-sectional area shown in Figure 3. The original length of the member was 100-in long. After applying the compressive force, the member was 99-in long. The modulus of elasticity for the material used in the cross section is 10,000 lb/. Use the following equations along with those in #2 and #3 to complete the problem. Show your work and calculations.**

**Part 2: Calculate the tension force for the cross-sectional area shown in Figure 3. The original length of the member was 100-in long. After applying the tensile force, the member was 103-in long. The modulus of elasticity for the material used in the cross section is the same as in #2 above. Use the following equations along with those in #2 and #3 to complete the problem. Show your work and calculations.**

= E \* = stress

= change in length / original length = strain

E = modulus of elasticity

change in length = (length after force applied) – (original length)

If the change in length is negative, take the absolute value to get a positive number

force = \* cross-sectional area

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**Part 1 Answer:**

Change in length = 99 inches - 100 inches = -1 inch

Taking the absolute value, change in length = 1 inch

= 1 inch / 100 inches = 0.01

= (10,000 lb/) x (0.01) = 100 lb/

Cross-sectional area = (17 inches) x (39 inches) – (13 inches) x (33 inches) = 234

Force = (100 lb/) x (234 ) = 23,400 lb

**Part 2 Answer:**

Change in length = 103 - 100 inches = 3 inches

= 3 inches / 100 inches = 0.03

= (10,000 lb/) x (0.03) = 300 lb/

**Figure 3: Cross-sectional area.** Cross-sectional area = (17 inches) x (39 inches) – (13

inches) x (33 inches) = 234

Force = (300 lb/) x (234 ) = 70,200 lb