Exam 1

Spring 2010-2011

Name: _____ CM: _____

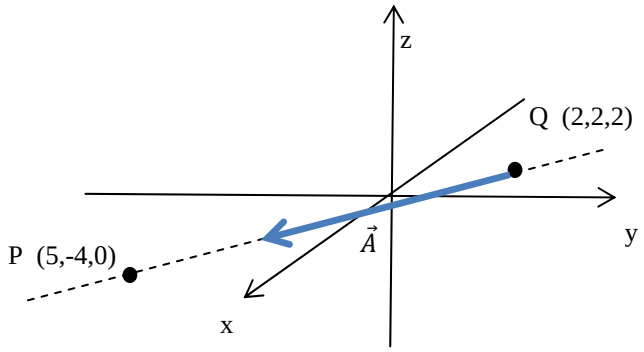
Section:_____

Problem 1 (35 pts)	_____
Problem 2 (30 pts)	_____
Problem 3 (35 pts)	_____
Total	_____

Be sure to show all work to receive full credit. However, "given" and "find" are not necessary.

Problem 1 – Short Answer -- *35 points*

(a) Point Q has coordinates (2,2,2). A force, $\vec{A}$, whose magnitude is 70 N, acts at Q along a line toward Point P (5, -4, 0).

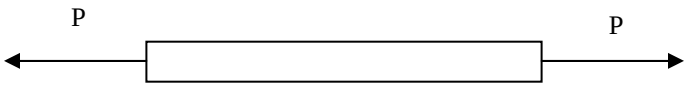


i. Write force $\vec{A}$ in Cartesian vector form.

ii. What angle does force $\vec{A}$ make with the x-axis? Give your answer in degrees.

(c) An aluminum bar has the following specifications:

Length	10 in
Diameter	0.505 in
Cross sectional area	0.2 in^2
Modulus of Elasticity	1.0×10^7 lb/in^2
Yield Strength	38,000 lb/in^2
Ultimate Tensile Strength	65,000 lb/in^2
Coefficient of Thermal Expansion	$12.5 \times 10^{-6}/^oF$



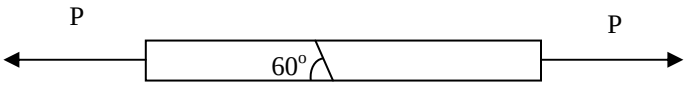
i. If the bar carries an axial force of 3100 lb, calculate the axial strain.

ii. Calculate the smallest force which would leave a noticeable plastic (permanent) deformation after unloading.

iii. What is the smallest applied force which would cause the bar to break?

iv. If we heat the bar up by 50^oF, what is the change in length of the bar?

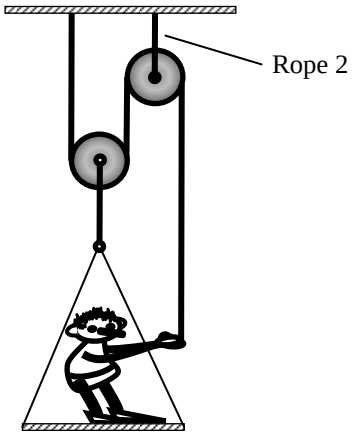
(d) A 1/8" diameter wooden dowel is sliced at a 60^o angle, and then it is joined with glue. What is the normal stress on the glued plane due to an applied force of 100 pounds?



Problem 2 – *30 points*

A window washer uses a system of frictionless and massless pulleys to hoist himself up the side of a building. The ropes in the pulley system are light and inextensible. The window washer has a weight of *W* and the platform on which he stands has negligible weight.

(a) Find the force with which the window washer pulls on the rope in terms of the weight *W*.
(b) Find the tension in Rope 2 in terms of the weight *W*.
(c) Find the force the window washer's feet exert on the platform in terms of the weight *W*.



Problem 3 – *35 points*

Three cylindrical bars (I, II, and III) are attached to each other and to a wall at one end, and are loaded as shown below. Sections I and III are hollow with an inner diameter of 20 mm and an outer diameter of 30 mm. Section II has a solid, circular cross-section of an unknown diameter.

(a) Find the reaction force at the wall.
(b) Determine the average normal stress in section III.
(c) If the stress in section II cannot exceed 50 MPa, determine the minimum diameter of the solid cylinder in section II.