

# PASS MOCK EXAM

– FOR PRACTICE ONLY –

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Dates and locations of mock exam take-up: location TBD, dates & times Thursday March 5<sup>th</sup> 4-5:30pm and Friday March 6<sup>th</sup> 5:30-7:00pm

Name: \_\_\_\_\_

It is **most beneficial** to you to write this mock midterm **UNDER EXAM CONDITIONS**. This means:

- **Complete the midterm in 1.5 hour(s).**
- Work on your own.
- Keep your notes and textbook closed.
- Attempt every question.

After the time limit, go back over your work with a different colour or on a separate piece of paper and try to do the questions you are unsure of. Record your ideas in the margins to remind yourself of what you were thinking when you take it up at PASS.

The purpose of this mock exam is to give you practice answering questions in a timed setting and to help you to gauge which aspects of the course content you know well and which are in need of further development and review. Use this mock exam as a **learning tool** in preparing for the actual exam.

Please note:

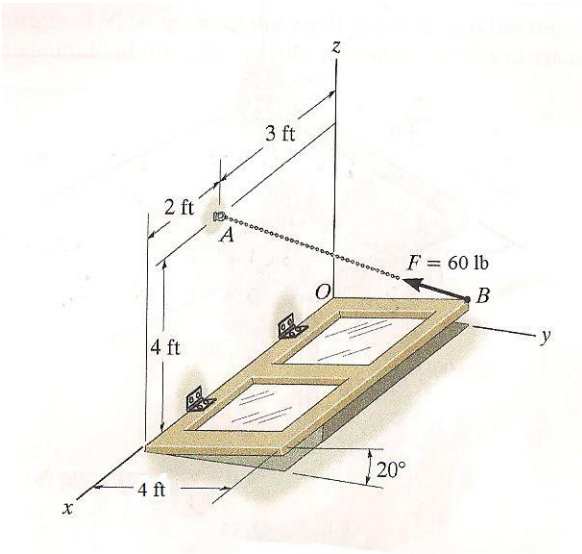
- Come to the PASS session with your mock exam complete. There, you can work with other students to review your work.
- Often, there is not enough time to review the entire exam in the PASS session. Decide which questions you most want to review – the Facilitator may ask students to vote on which questions they want to discuss.
- Facilitators do not bring copies of the mock exam to the session. Please print out and complete the exam before you attend.
- **Facilitators do not produce or distribute an answer key for mock exams.** Facilitators help students to work together to compare and assess the answers they have. If you are not able to attend the PASS session, you can work alone or with others in the class.

**Good Luck writing the Mock Midterm!!**

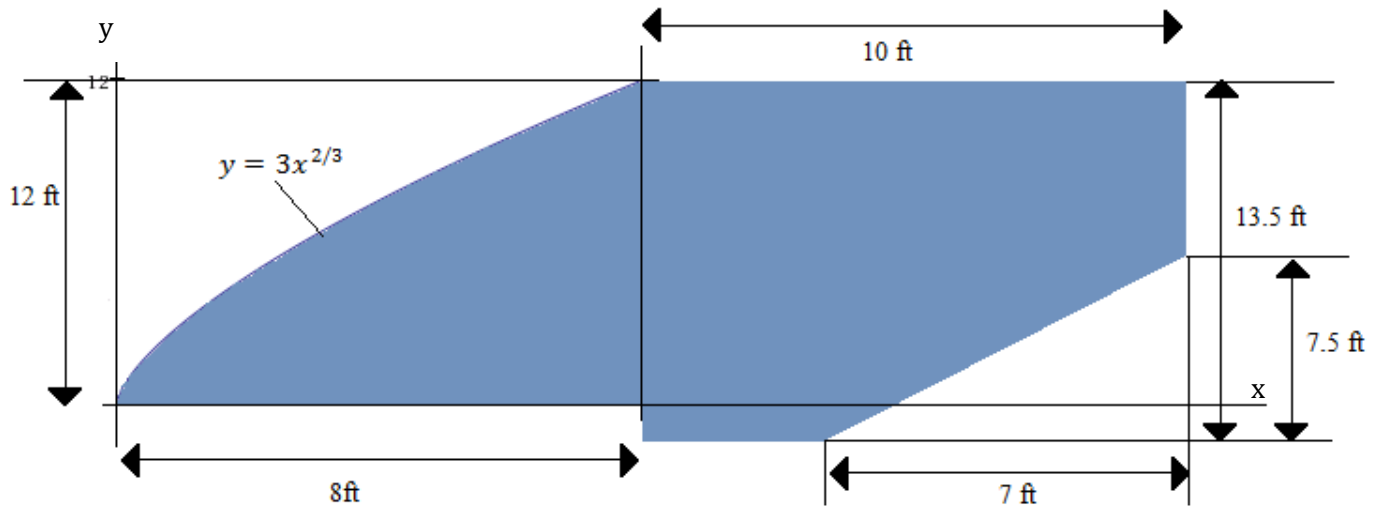
**DISCLAIMER:** PASS handouts are designed as a study aid only for use in PASS workshops. Handouts may contain errors, intentional or otherwise. It is up to the student to verify the information contained within.

**PLEASE NOTE: THIS HANDOUT IS NOT TO BE DISTRIBUTED.**

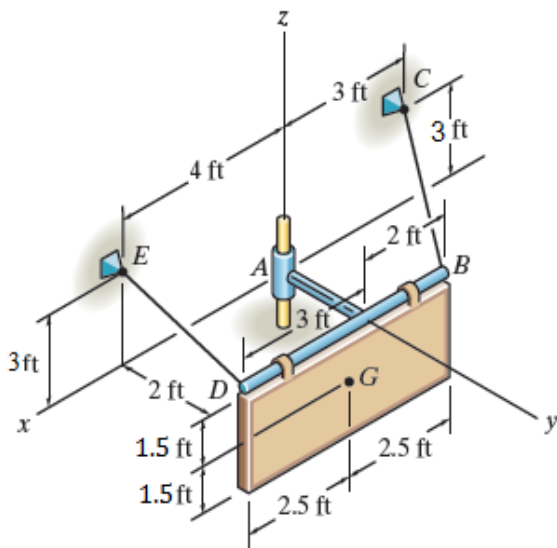
**Q1.** The chain AB exerts a force of 60 lbs on the door at B. Determine the magnitude of the moment of this force along the hinged axis x of the door.



**Q2.** Solve for the centroid of the blue figure below



**Q3.** Determine the tension in the cables and the components of reaction acting on the smooth collar at A necessary to hold the 80lb sign in equilibrium. The center of gravity for the sign is at G. \*Remember that for 3-D equations you can solve for 6 unknowns.



Typical Formula Sheet given in years past

**Note:** Bold letters indicate vectors

Vector:

$$\mathbf{F} = F_x \mathbf{i} + F_y \mathbf{j} + F_z \mathbf{k}$$

Magnitude:

$$F = \sqrt{F_x^2 + F_y^2 + F_z^2}$$

Unit vector:

$$\mathbf{u} = \mathbf{r} / r$$

Force vector:

$$\mathbf{F} = F \mathbf{u}$$

Direction cosines:

$$\cos \alpha, \cos \beta \text{ \& \ } \cos \gamma$$

$$\cos \alpha = F_x / F$$

Dot product:

$$\begin{aligned} \mathbf{A} \cdot \mathbf{B} &= A B \cos \alpha \\ &= A_x B_x + A_y B_y + A_z B_z \end{aligned}$$

Cross product:

$$\begin{aligned} \mathbf{A} \times \mathbf{B} &= A B \sin \alpha \mathbf{u} \\ &\text{(Given by the determinant)} \\ \mathbf{u} &\text{ unit vector perpendicular to } \mathbf{A}, \mathbf{B} \end{aligned}$$

Dynamics:

$$v = ds/dt$$

$$a = dv/dt = d^2s/dt^2$$

also  $a ds = v dv$

For constant acceleration:

$$v = v_0 + at$$

$$\Delta s = v_0 t + \frac{1}{2} at^2$$

$$v^2 = v_0^2 + 2 a (\Delta s)$$

Tangential & normal acceleration:

$$\mathbf{a} = a_t \mathbf{u}_t + a_n \mathbf{u}_n$$

$$a_t = dv/dt$$

$$a_n = v^2/\rho$$

Cylindrical components:

$$v_r = \dot{r}$$

$$v_\theta = r \dot{\theta}$$

$$a_r = \ddot{r} - r \dot{\theta}^2$$

$$a_\theta = r \ddot{\theta} + 2 \dot{r} \dot{\theta}$$

Position vector:

$$\mathbf{r}_{AB} = (X_B - X_A)\mathbf{i} + (Y_B - Y_A)\mathbf{j} + (Z_B - Z_A)\mathbf{k}$$

Moment:

$$\mathbf{M} = \mathbf{r} \times \mathbf{F}$$

Moment along a specified axis:

(direction: unit vector  $\mathbf{u}$ )

$$M_u = (\mathbf{r} \times \mathbf{F}) \cdot \mathbf{u}$$

(Given by the triple scalar product)

General equilibrium equations:

$$\sum \mathbf{F} = \mathbf{0}$$

$$\sum \mathbf{M} = \mathbf{0}$$

Equilibrium equations in 2D:

$$\sum F_x = 0$$

$$\sum F_y = 0$$

$$\sum M_z = 0$$

Centre of gravity:

$$\bar{x} = \frac{\int x dW}{\int dW}$$

Curvature:

$$\rho = \frac{\left[ 1 + \left( \frac{dy}{dx} \right)^2 \right]^{3/2}}{\left| \frac{d^2y}{dx^2} \right|}$$

Slope:

$$\tan(\alpha) = \frac{dy}{dx}$$

Principle of work/energy:

$$\frac{1}{2}mV_1^2 + U_{1-2} = \frac{1}{2}mV_2^2$$

Conservation of mechanical energy:

$$\frac{1}{2}mV^2 + mgh + \frac{1}{2}kS^2 = \text{constant}$$

where:

$\frac{1}{2}mV^2$  = kinetic energy

$mgh$  = gravitational potential energy

$\frac{1}{2}kS^2$  = elastic potential energy