UNIVERSITY OF ARKANSAS

(Closed books & closed notes)

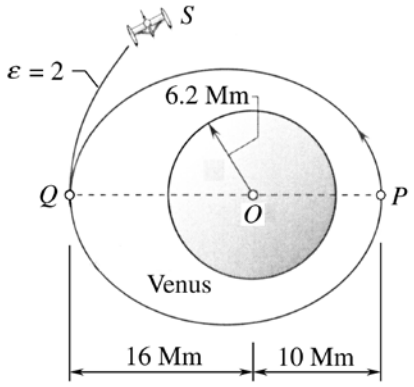
MEEG 4003

Name: _____
(Underline your **last name**.)

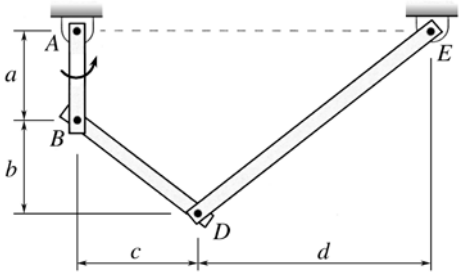
ID#: _____

## Midterm Exam (Part B)

**2.** (30%) A spacecraft approaches the planet Venus along a hyperbolic trajectory *SQ* of eccentricity $\varepsilon = 2$ as shown. As it reaches the vertex *Q* of the trajectory *SQ*, its retrorockets are fired momentarily to decrease its speed and insert itself into an elliptic orbit as indicated. The ratio of the mass of Venus to the mass of the Earth is known to be 0.8144. For the spacecraft, determine (*a*) its speed as it approaches *Q*, (b) its speed after the firing of the retrorockets, (*c*) the time $t_{QP}$ elapsed as it travels from *Q* to *P*.




**3.** (30%) Refer to the four-bar linkage shown. It is known that $a = b = 3$ ft, $c = 4$ ft, $d = 8$ ft, and the crank *AB* rotates with angular acceleration $\boldsymbol{\alpha}_{AB} = 6$ rad/s$^2$ ↺ as well as angular velocity $\boldsymbol{\omega}_{AB} = 10$ rad/s ↺ at the instant shown. For this instant, determine (a) the angular accelerations $\boldsymbol{\alpha}_{BD}$ and $\boldsymbol{\alpha}_{DE}$ of the coupler link *BD* and the output link *DE*, (*b*) the acceleration $\mathbf{a}_D$ of the pin at *D*.




**4.** (10%) Circle on this test sheet the correct or nearest item for each of the following:

*A.* A spacecraft *S* is in free flight around the earth at an altitude of $a_0 = 270$ mi. Its period of orbit is
(*a*) 92.5 min. (*b*) 92.8 min. (*c*) 93.2 min. (*d*) 93.5 min. (*e*) 93.8 min.
(*f*) 94.2 min. (*g*) 94.5 min.

*B.* The transverse component of acceleration of a particle is
(*a*) $v^2/\rho$. (*b*) $r\ddot{\theta} + 2\dot{r}\dot{\theta}$. (*c*) $\ddot{r} + r\dot{\theta}^2$. (*d*) $\ddot{\theta}$. (*e*) $dv/dt$. (*f*) $\ddot{r} - r\dot{\theta}^2$. (*g*) $\ddot{r}$.