Physics 3210

Week 5 clicker questions

The central-force Lagrangian is $\mathcal{L} = \frac{1}{2}\mu\left(\dot{r}^2 + r^2\dot{\theta}^2\right) - U(r)$

What is the Lagrangian equation of motion in r?

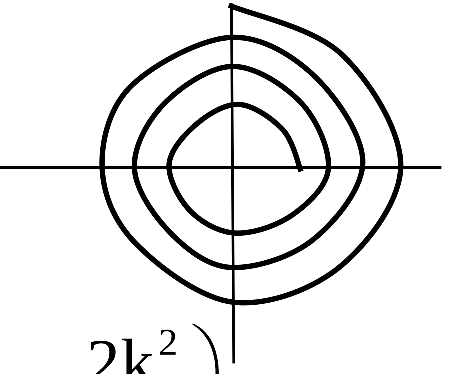
A. $\mu\left(\ddot{r} - r\dot{\theta}^2\right) = F(r)$

B. $\mu\left(\ddot{r} - r\dot{\theta}^2\right) = U(r)$

C. $\mu\left(\dot{r} - r\ddot{\theta}\right) = F(r)$

D. $\mu\left(\dot{r} - r^2\dot{\theta}\right) = U(r)$

A particle is observed to move in a spiral orbit r=kθ. What is the force law that produces this orbit?



A. $F(r) = \frac{-\ell^2}{\mu r^2}\left(1 + \frac{2k^2}{r^2}\right)$

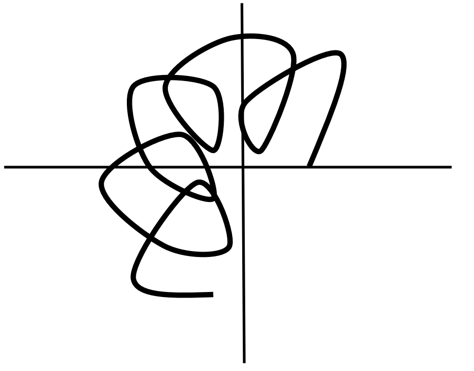
B. $F(r) = \frac{-\ell^2}{\mu r^2}\left(1 + \frac{2}{r^3}\right)$

C. $F(r) = \frac{-\ell^2}{\mu r^2}\left(1 + \frac{k^2}{r^3}\right)$

D. $F(r) = \frac{-\ell^2}{\mu r^3}\left(1 + \frac{2k^2}{r^2}\right)$

E. $F(r) = \frac{-\ell^2}{\mu r^3}\left(1 + \frac{k}{r^2}\right)$

A particle moves in an orbit where its radius alternately increases and decreases with time. What determines the turning points of the motion?



A. $r = 0$

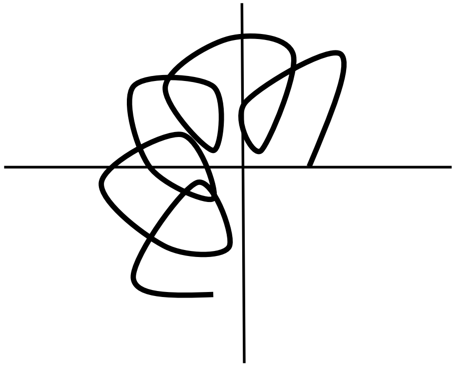
B. $\frac{dr}{dt} = 0$

C. $\frac{d^2r}{dt^2} = 0$

D. $\frac{dr}{d\theta} = 0$

E. $\frac{d^2r}{d\theta^2} = 0$

In one transit from r_{min} back to r_{min}, an orbit moves by an angle $\Delta\theta$. What condition on $\Delta\theta$ must hold if the orbit closes on itself?



A. $\Delta\theta = 0$

B. $\Delta\theta = 2\pi$

C. $\Delta\theta = 2\pi a$, a integer

D. $\Delta\theta = \dfrac{2\pi}{a}$, a integer

E. $\Delta\theta = \dfrac{2\pi a}{b}$, a and b integers

Physics 3210 Week 5

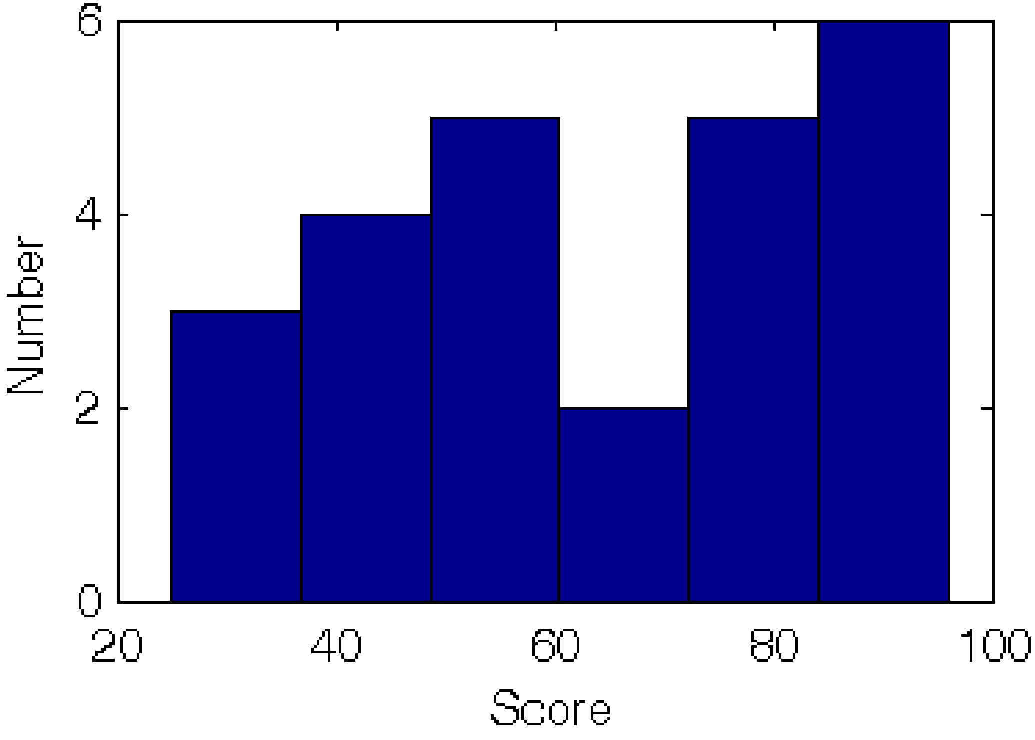
Wednesday clicker questions

Exam grade distribution

Median = 66

Standard deviation = 22

Current course grade=55% exam, 45% homework



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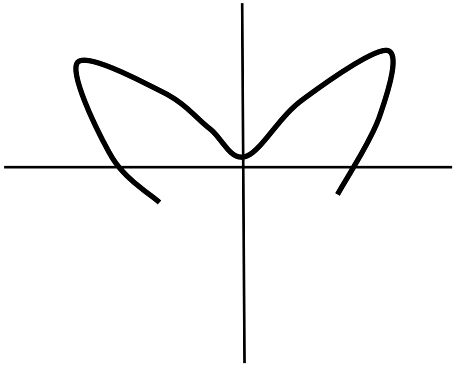

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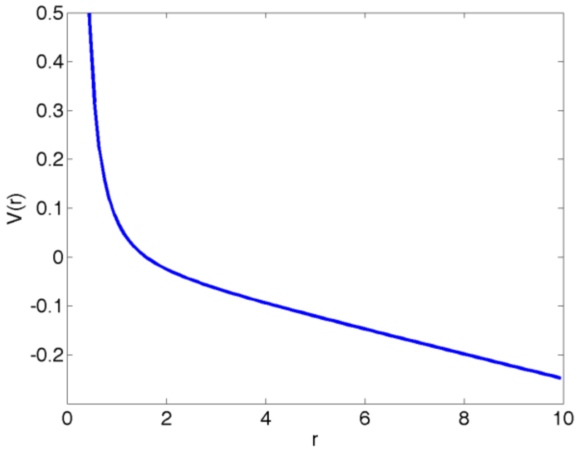
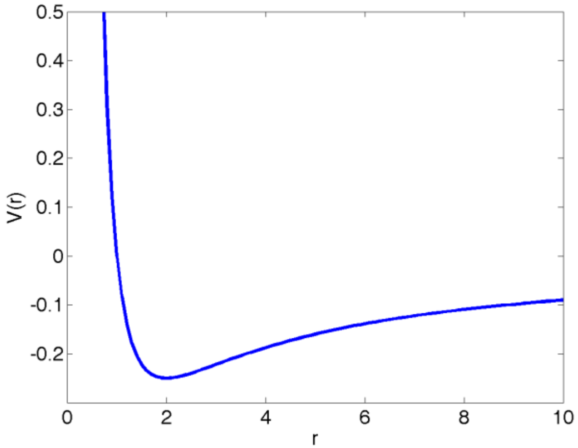
E. $\Delta\theta = \frac{2\pi a}{b}$, a and b integers

Which of these plots show a physically possible V(r) for the gravitational potential?

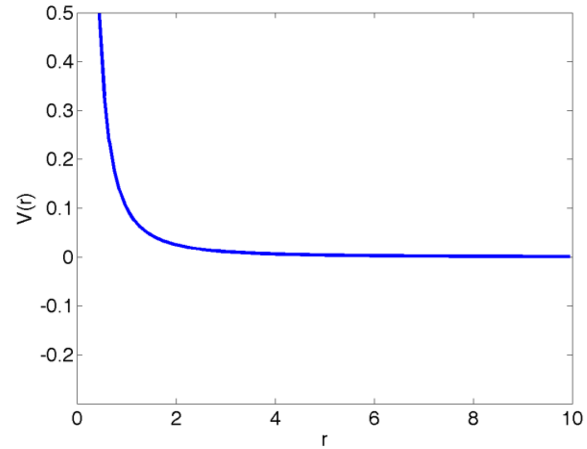
A.



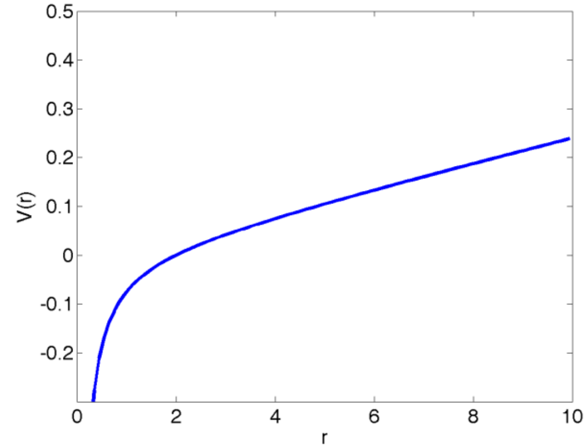
B.



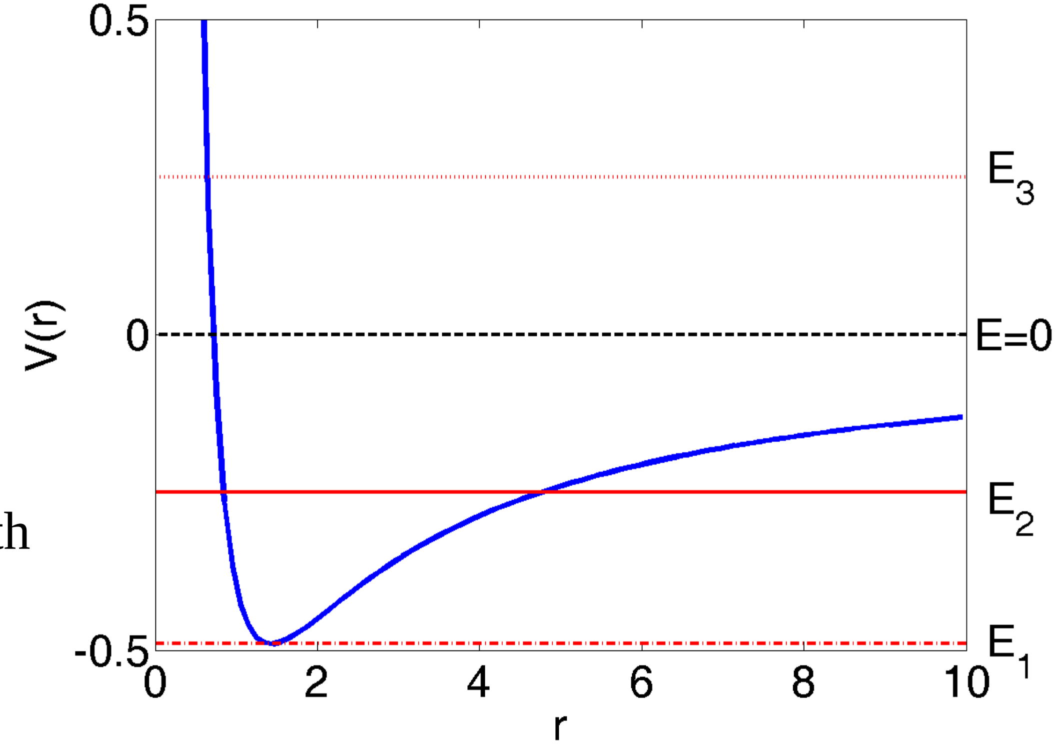
C.



D.



For motion in gravitational potential characterized by V(r) as plotted, what type of motion corresponds to total energy E_2?



A. Bounded circular motion with a fixed r.

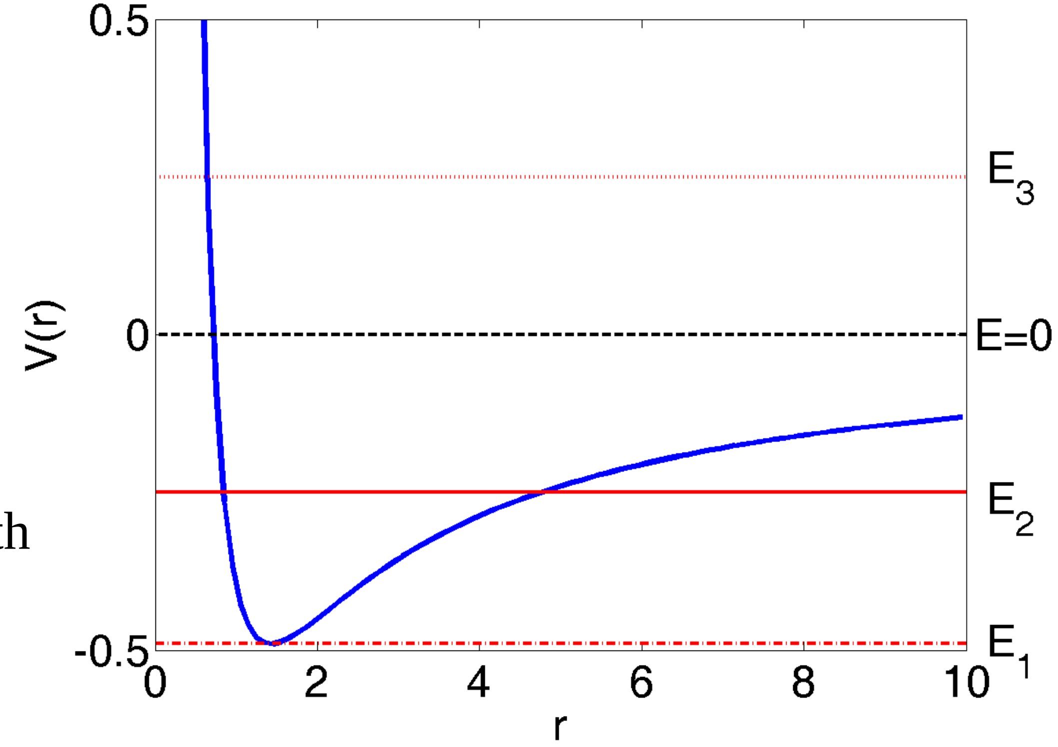
B. Bounded motion between a minimum and maximum r.

C. Unbounded motion with a minimum r but no maximum r.

D. Unbounded motion with neither a minimum nor a maximum r.

For motion in gravitational potential characterized by V(r) as plotted, what type of motion corresponds to total energy E_1?

A. Bounded circular motion with a fixed r.
B. Bounded motion between a minimum and maximum r.
C. Unbounded motion with a minimum r but no maximum r.
D. Unbounded motion with neither a minimum nor a maximum r.



Given the equation $\cos\theta = \dfrac{\dfrac{\ell^2}{\mu k}\dfrac{1}{r} - 1}{\sqrt{1 + \dfrac{2E\ell^2}{\mu k^2}}}$

and the constants $\alpha = \dfrac{\ell^2}{\mu k}$, $\varepsilon = \sqrt{1 + \dfrac{2E\ell^2}{\mu k^2}}$

what is the correct way to rewrite the orbit equation?

A. $\dfrac{r}{\alpha} = -1 + \varepsilon\cos\theta$

B. $\dfrac{r}{\alpha} = 1 - \varepsilon\cos\theta$

C. $\dfrac{\alpha}{r} = 1 - \varepsilon\cos\theta$

D. $\dfrac{r}{\alpha} = 1 + \varepsilon\cos\theta$

E. $\dfrac{\alpha}{r} = 1 + \varepsilon\cos\theta$

We showed that $V_{min} = -\frac{\mu k^2}{2\ell^2}$

What is the correct value of ε when $E=V_{min}$?

A. $\varepsilon = 1$

B. $\varepsilon = 0$

C. $\varepsilon = -1$

D. $\varepsilon = 2$

E. $\varepsilon = -2$

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Friday clicker questions

We showed that $V_{min} = -\frac{\mu k^2}{2\ell^2}$

What is the correct range of ε when $V_{min} < E < 0$?

A. $\varepsilon = 1$

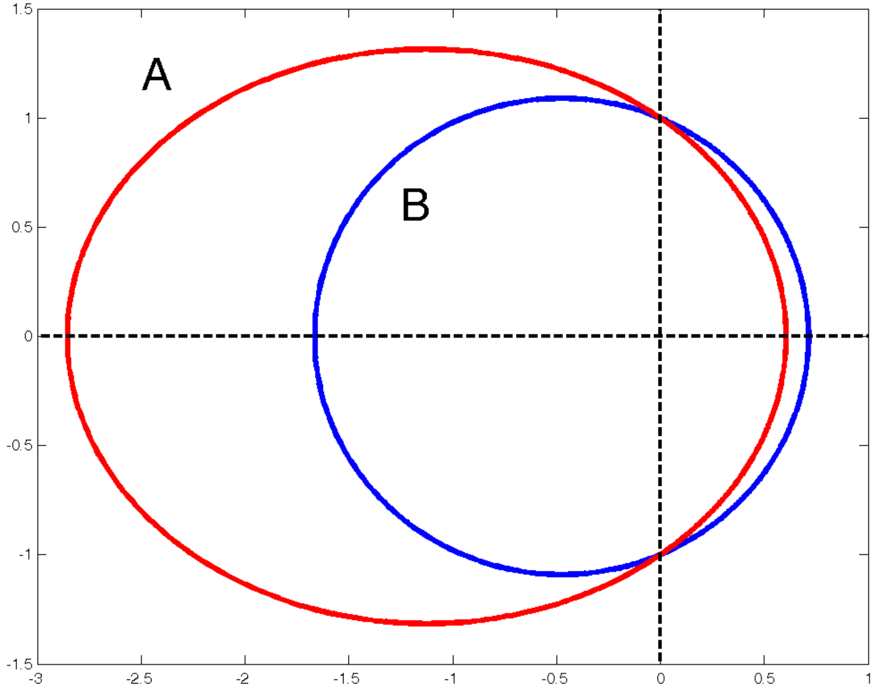
B. $\varepsilon = 0$

C. $-1 < \varepsilon < 0$

D. $0 < \varepsilon < 1$

E. $1 < \varepsilon < 2$

Which orbit corresponds to motion with larger total energy?



C. The orbits correspond to motion with equal energy.

D. It cannot be determined from the information given.

What is the correct value of ε when E=0?

A. $\varepsilon = 1$

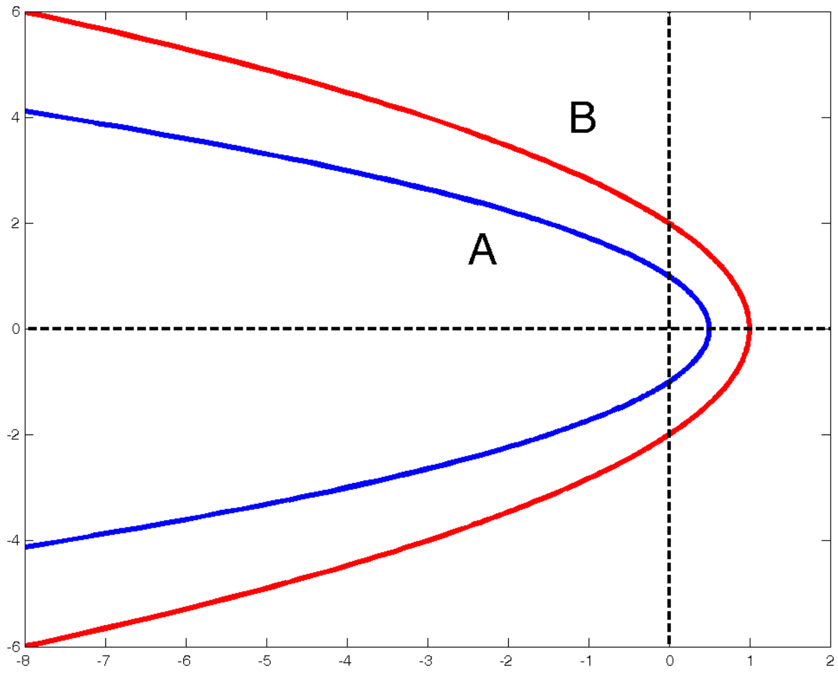
B. $\varepsilon = 0$

C. $\varepsilon = -1$

D. $\varepsilon = 2$

E. $\varepsilon = -2$

Which parabolic orbit corresponds to motion with larger angular velocity (at a given angle)?



C. The orbits correspond to motion with equal angular velocity.

D. It cannot be determined from the information given.

What is the correct range of ε when E>0?

A. $\varepsilon < 0$

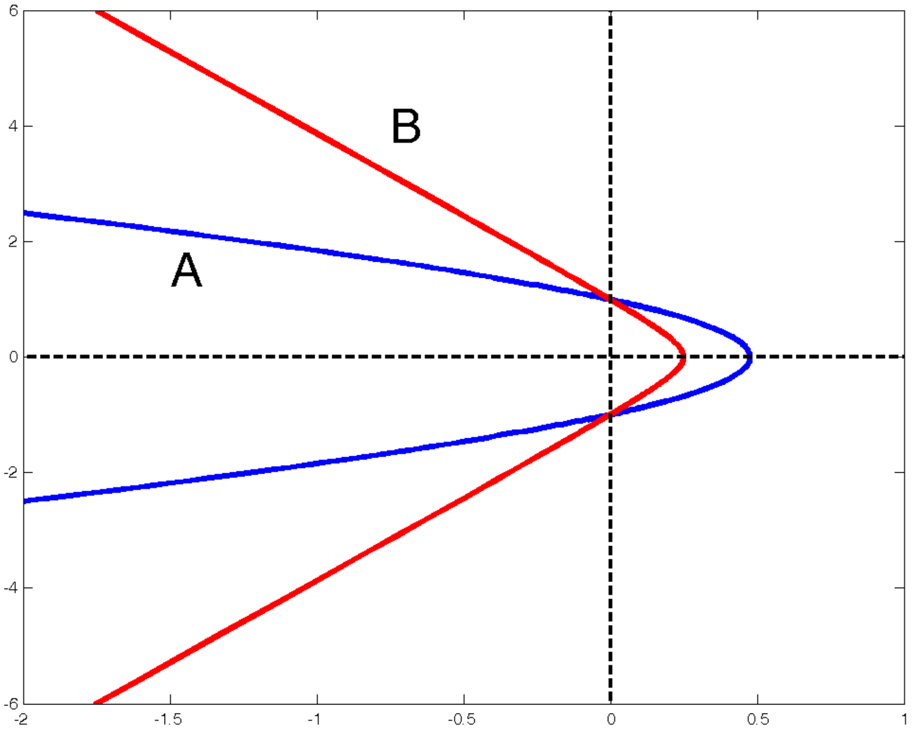
B. $\varepsilon = 0$

C. $0 < \varepsilon < 1$

D. $1 < \varepsilon < 2$

E. $\varepsilon > 1$

Which hyperbolic orbit corresponds to motion with larger total energy?



C. The orbits correspond to motion with equal energy.

D. It cannot be determined from the information given.