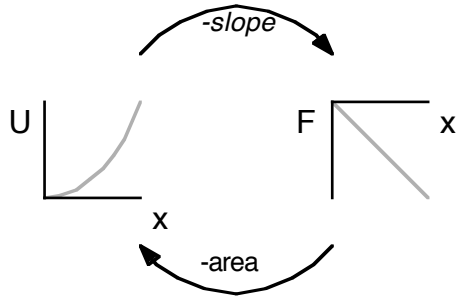
NAME: KEY

Potential Energy Graphs

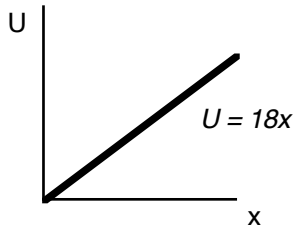
What am I trying to show with the picture to the right?

Why are there negative signs?



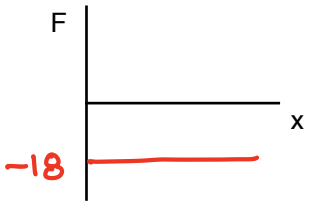
1. For each of the following Potential Energy functions/graphs, find the corresponding Force functions and graphs.

a.

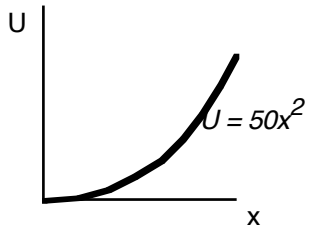


$F = -\frac{d}{dx}(18x)$

$F = -18$

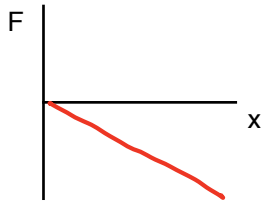


b.

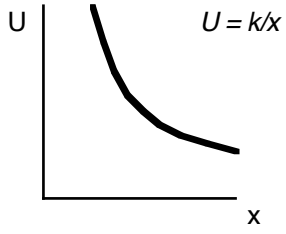


$F = -\frac{d}{dx}(50x^2)$

$F = -100x$

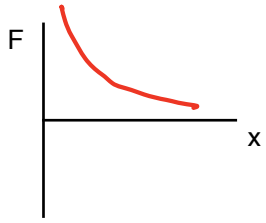


c.

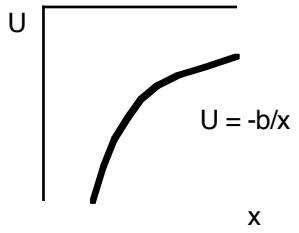


$F = -\frac{d}{dx}\left(\frac{k}{x}\right)$

$F = \frac{k}{x^2}$

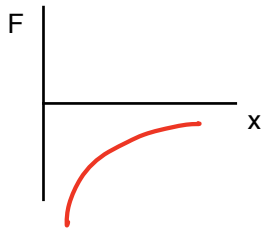


d.



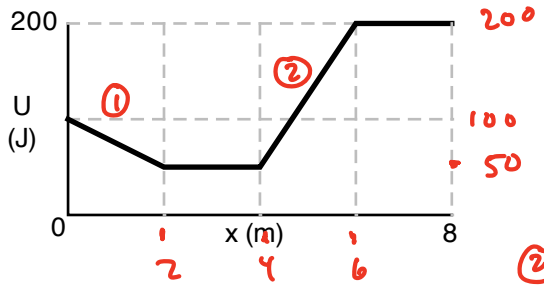
$F = -\frac{d}{dx}\left(-\frac{b}{x}\right)$

$F = -\frac{b}{x^2}$



Potential Energy Graphs

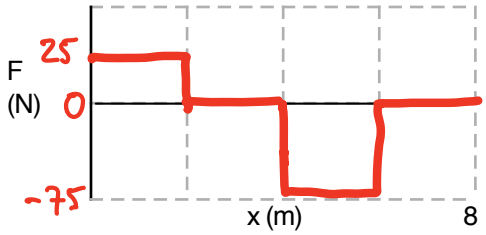
2. Imagine the potential energy function for a 3 kg object looks like the following:



a. Graph the force.

① $-\frac{-50}{2} = 25$

② $-\frac{(150)}{2} = -75$



b. Where could the object have zero speed, and be in neutral equilibrium?

$2 < x < 4$

$6 < x < 8$

c. In which direction is the force on the object between 0 and 2 m?

+ (to the right)

d. In which direction is the force on the object between 4 and 6 m?

− (to the left)

e. If the object had a total mechanical energy of 50 J, where could it be?

$2 < x < 4$ where $U = 50$ (so it would have $K = 0$)

f. If the object had a total mechanical energy of 100 J, where could the object be?

$0 < x < 4\frac{2}{3}$ where $U \leq 100$ J

g. If the object had total mechanical energy of 100 J, what is the range of possible kinetic energies the object could have?

Since the minimum U is 50 J,

and $K + U = 100$, $0 < K < 50$

oscillate region

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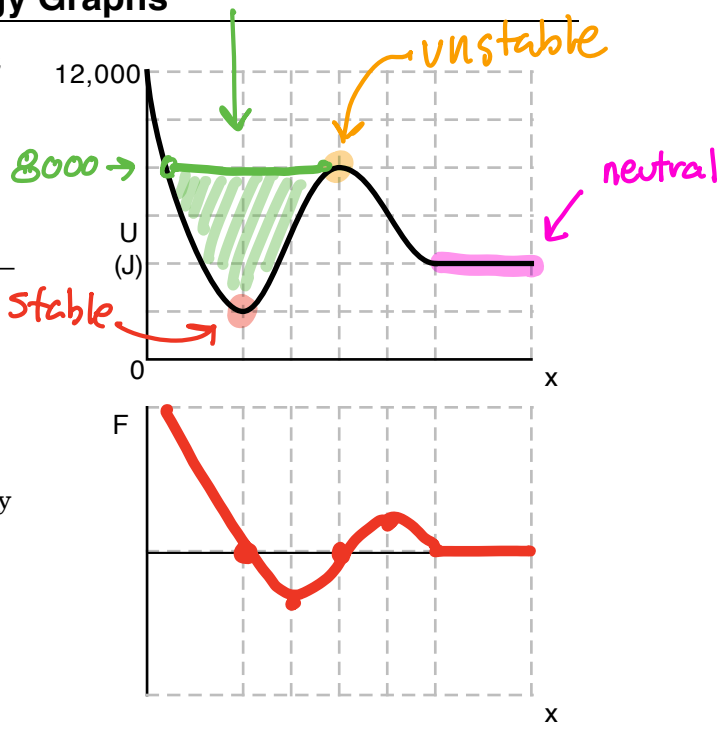
Potential Energy Graphs

3. Imagine the potential energy function for an object looks like the following: (Assume that the dashed axes line up with inflection points, maxima or minima.



   a. Sketch the force function.

   b. Mark where the object could be in equilibrium – and label whether it is stable, unstable or neutral.

   c. Mark the region where the object could possibly be oscillating back and forth?

green region

   d. What is the maximum energy the object could have, and be oscillating back and forth?

8000J

   e. What is the maximum kinetic energy the object could have if it was oscillating back and forth?

8000 − 2000 = 6000 J

(U_{min})

   f. If the object had 6000 J of total mechanical energy, where could the object be located and what could the object be doing?

either in the oscillating region oscillating (going back & forth) or moving off to the right (forever)

Answers:

1. *a) F=–18* *b) F=–100x* *c) F=k/x²* *d) F=–b/x²*
2. *b) 2-4 & 6-8* *c) right* *d) left* *e) 2-4* *f) 0-4.67* *g) 0-50 J*
3. *d) 8000 J* *e) 6000 J*

   f) either oscillating or moving to the right (if left, would stop and turn around.)