04 Basic Work Energy

July 26, 2021

1 Basic Sample problems Energy and Work

- Remember that P= mparticle() … then
- Some function used in Energy
  - P.energia() = Sumatory Energy in A an B
    - P.energia(ktype='1') = Energy in A
    - P.energia(ktype='2') = Energy in B
    - P.energia(ktype='P1') = Energy Potential in A
    - P.energia(ktype='E1') = Energy kcinetic in A
    - etc.
  - P.simple_ac() = (Sum Force in X)/ mass
  - P.simple_ac(ktype='y') = (Sum Force in Y)/ mass

[1]:
```
from sympy import *
from polyclass import *
from libaldo_math import *
from libaldo_show import *
from physic_lib import *
from IPython.display import display, Math
init_printing()
```

[2]:
```
# Declaring P object with data get by problem
P=mparticle(m=0.2,g=10,x1=0,x2=20,y1=0,y2=20)  # remmeber put x,y position if␣
↪you have
```

[3]:
```
# Total Energy in A = Total Energy in B
P.energia(ktype='p2') # ktype ='1' Energy total in A, 2=B, P1 pot in A pP2 is␣
↪pot in B  . E1 is Enr Kcin in A. etc.
```

[3]:
40.0

[4]:
```
show_res(30+40,'Energy  \ in \ A \ is')
```

$Energy\ in\ A\ is = 70$

[5]:
```
N1,fr,T=symbols('N1 fr T')
P=mparticle(m=4,g=10,x1=0,x2=1,ac=2,y1=0,y2=0)
```

[6]:
```
P.add_forza(40,-pi/2)
P.store_val(N1,40)
P.add_forza(N1,pi/2)
P.store_val(fr,N1*0.2)
P.add_forza(fr,-pi)
P.add_forza(T,0)
```

[7]:
```
P.work_x()
```

[7]:
$$T - 8.0$$

[8]:
```
csolve(P.simple_ac('x')-2,T)
```

[8]:
$$16.0$$

[9]:
```
P.store_val(T,16)
```

[10]:
```
P.work_x()
```

[10]:
$$8.0$$

[11]:
```
P=mparticle(y1=32,y2=1,v1=40,x1=0,g=10)
```

[12]:
```
P.energia()
```

[12]:
$$\frac{mv_2^2}{2} - 1110m$$

[13]:
```
# answer default
v=csolve(P.energia(),v2,'v') # total sol
```

$$v = \left[-2\sqrt{555},\ 2\sqrt{555}\right]$$

[14]:
```
# the same answer but  ...
v=csolve(P.energia(),v2,'v',kpositive=True) # only possitive
```

$$v = 2\sqrt{555}$$

[15]:
```
# the same answer but usefull type
v=csolve(P.energia(),v2,'v',kpositive=True,kope='v')#   possitive and float
```

$$v = 47.116875957559$$

[16]:
```
# Creating object to use from A to B
R=symbols('R')
P=mparticle(x1=0,x2=R,y1=R,y2=0,v1=0)
```

[17]:
```
V2=csolve(P.energia(),powsimp(v2**2),'V_2') # is more easy fin squarw(V2)␣
 ↪because used
```

$V_2 = 2Rg$

[18]:
```
# Creating object to use from B to C
h=symbols('h')
P2=mparticle(x1=0,y1=h,y2=0,v=sqrt(2*R*g),a=0,ac=0) # using parabolic setup
```

[19]:
```
P2.y_pos()
```

[19]:
$$-\frac{gt^2}{2} + h$$

[20]:
```
csolve(P2.y_pos(),t**2) # Find t^2 when y2=0
```

[20]:
$$\frac{2h}{g}$$

[21]:
```
P2.x_pos(t=sqrt(2*h/g),kope='2') # Find x when t=upper answer and kill sqrt␣
↪whit kope='2'
```

[21]:
$$2\sqrt{Rh}$$

[22]:
```
# kope options..?? see below
opemat?
```

```
Signature: opemat(ksym, kope='')
Docstring:
opemat(Equation,kope=opt)
opt
    'f'= factor(Equation),
    't'= trigsimp(Equation)
    'x'= simplify(Equation)
    'v'= Equation.evalf()
    'a'= apart(Equation)
    'c'= cancel(Equation)
    'E'= Equation.expand(force=True)
    '2' = kill sqrt( x^2 )
File:      d:\onedrive\solvelib\fin_physic\libaldo_math.py
Type:      function
```

[23]:
```
m,h,L,beta,V=symbols('m h L beta V',positive=True)
A=mparticle(m=2*m,y1=h,y2=h+L*sin(beta),v1=0,v2=V,a=beta)
B=mparticle(m=m,y1=h,y2=h-3*L*sin(A.a),v1=0,v2=3*V)
```

[24]:
```
A.energia(ktype='1') # Energia Initial in A
```

[24]:
$$2ghm$$

[25]:
```
B.energia(ktype='1') # Energia Initial in B
```

[25]:
$$ghm$$

[26]:
```
Eq1=A.energia(ktype='1')+B.energia(ktype='1');Eq1
```

[26]:
$$3ghm$$

[27]:
```
A.energia(ktype='2') # Energia final in A
```

[27]:
$$V^2m + 2gm\left(L\sin\left(\beta\right) + h\right)$$

[28]:
```
B.energia(ktype='2') # Energia final in B
```

[28]:
$$\frac{9V^2m}{2} + gm\left(-3L\sin\left(\beta\right) + h\right)$$

[29]:
```
Eq2=A.energia(ktype='2')+B.energia(ktype='2');Eq2
```

[29]:
$$\frac{11V^2m}{2} + gm\left(-3L\sin\left(\beta\right) + h\right) + 2gm\left(L\sin\left(\beta\right) + h\right)$$

[30]:
```
Eq3=opemat((Eq1-Eq2)/m,'s') ;Eq3 # adding two Eq and simplify store in Eq3
```

[30]:
$$Lg\sin\left(\beta\right) - \frac{11V^2}{2}$$

[31]:
```
csolve(diff(Eq3,beta),beta) # find beta when diff Eq3=0
```

[31]:
$$\left[\frac{\pi}{2}, \frac{3\pi}{2}\right]$$

[32]:
```
# we will pick only first answer and store in both physic object
A.store_val(beta,pi/2)
A.kvalue
```

[32]:
$$\left(\left[\beta\right], \left[\frac{\pi}{2}\right]\right)$$

[33]:
```
B.store_val(A.a,pi/2)
B.kvalue
```

[33]:
$$\left(\left[\beta\right], \left[\frac{\pi}{2}\right]\right)$$

[34]:
```
# finding  total energy in the system but knowing beta
Eq4=A.energia(ktype='1')+B.energia(ktype='1')-(A.energia(ktype='2')+B.
↪energia(ktype='2'));Eq4
```

[34]:
$$-\frac{11V^2m}{2} + 3ghm - gm\left(-3L\sin\left(\beta\right) + h\right) - 2gm\left(L\sin\left(\beta\right) + h\right)$$

[35]:
```
Eq4=opemat(Eq4,'s')
Eq4
```

[35]:
$$\frac{m\left(2Lg\sin\left(\beta\right)-11V^{2}\right)}{2}$$

[36]:
```
csolve(Eq4,V,korden=1)  # Velocity whe angle is pi/2
```

[36]:
$$\frac{\sqrt{22}\sqrt{L}\sqrt{g\sin\left(\beta\right)}}{11}$$