Recap – T/N coordinates

- Being careful about algebraic problems with multiple solutions — draw diagrams.
- chain rule $r(\theta)$, $\theta(r)$

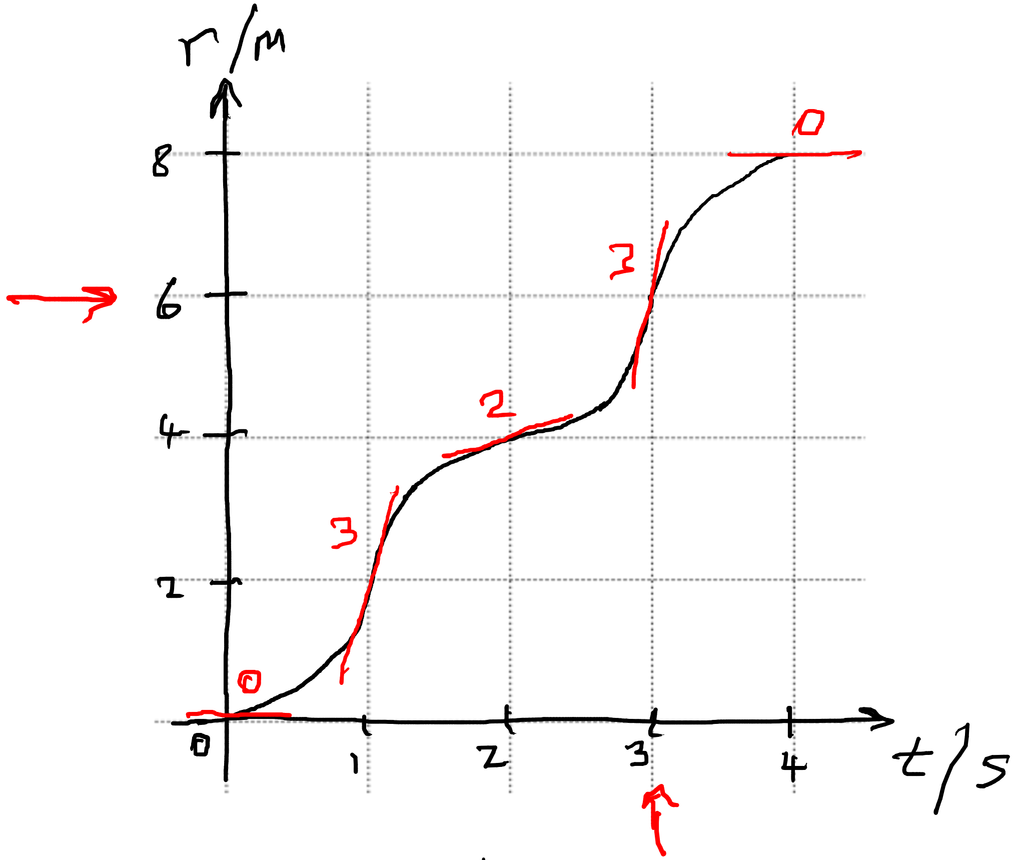
Today:
- iclickers
- schedule approaching Midterm 1
- James Scholar meeting today (Piazza)
- graphical path from last lecture
- torsion of a path
- Car backflip for next week's WS
- rigid bodies

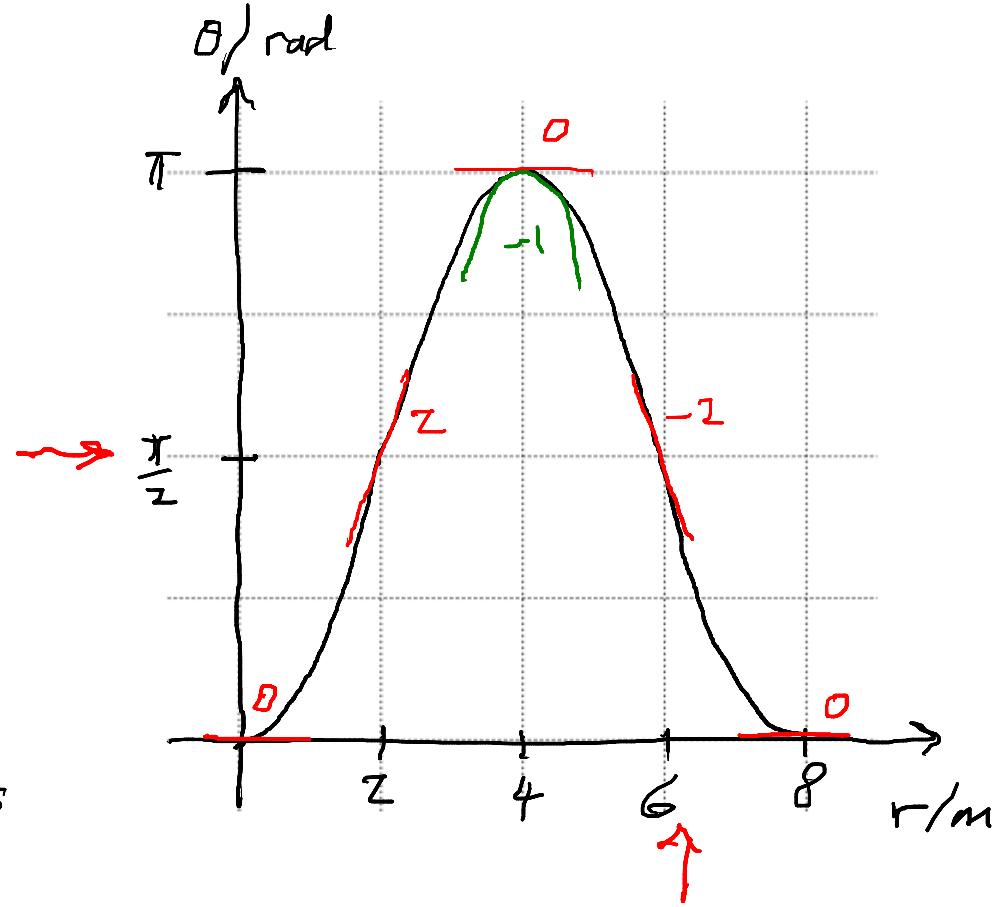
Prefer A. MC with 0/1 30%

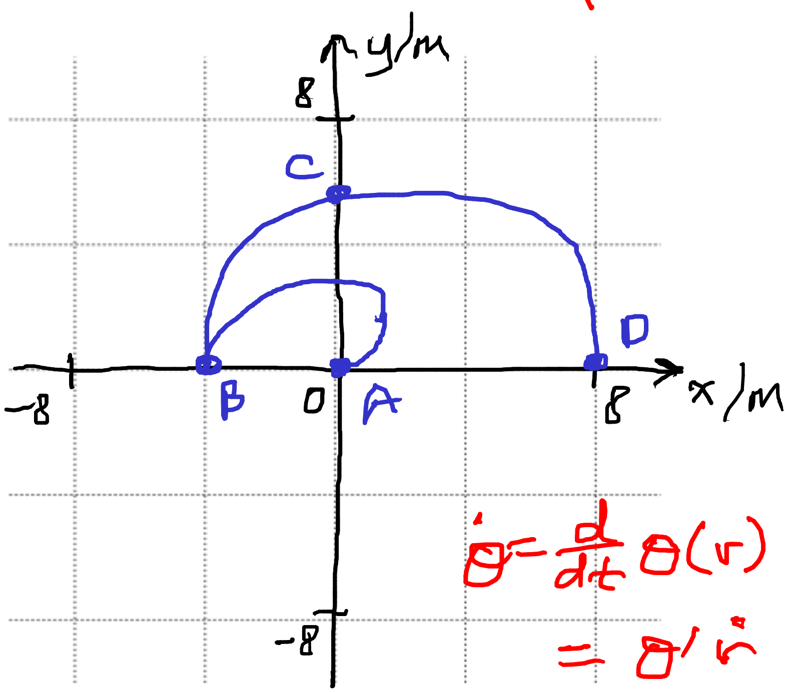
B. MC with partial points. 70%

Prefer A. 8am 50%

B. 6pm 50%.







$\dot{\theta} = \frac{d}{dt}\theta(r)$

$= \theta' \dot{r}$

At C, $\dot{\theta} =$

A. 6 rad/s

B. 2 rad/s

C. 0 rad/s

D. −2 rad/s

E. −6 rad/s

$\theta = \frac{\pi}{2}$

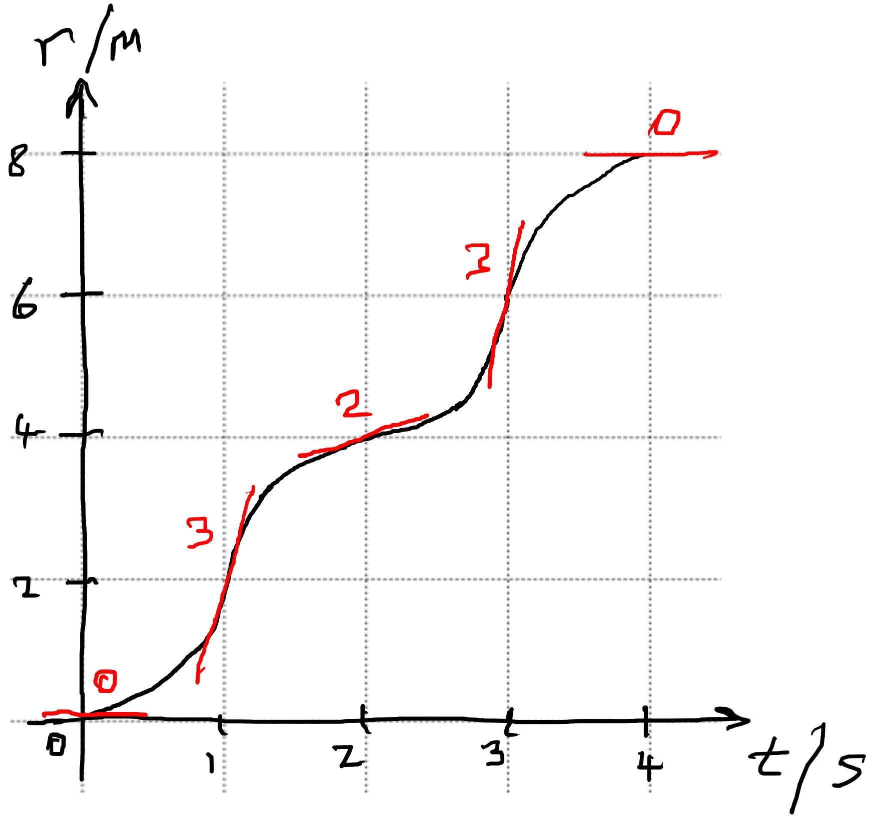
$r = 6$

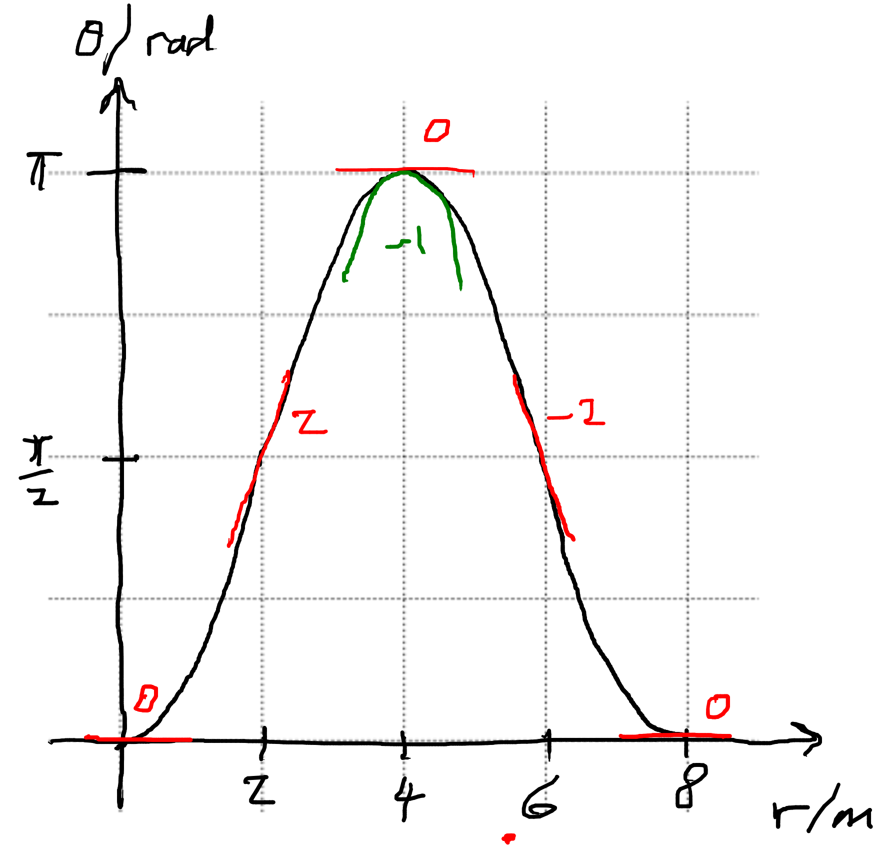
$t = 3$

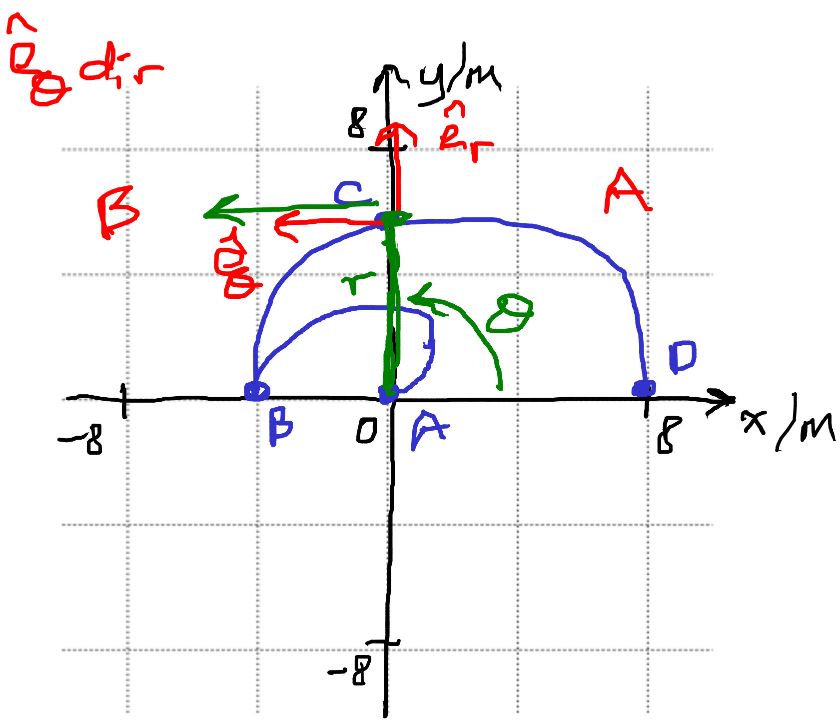
$\dot{r} = 3$

$\theta'(r) = -2$

$\dot{\theta} = \theta' \dot{r} = (-2)3 = -6$





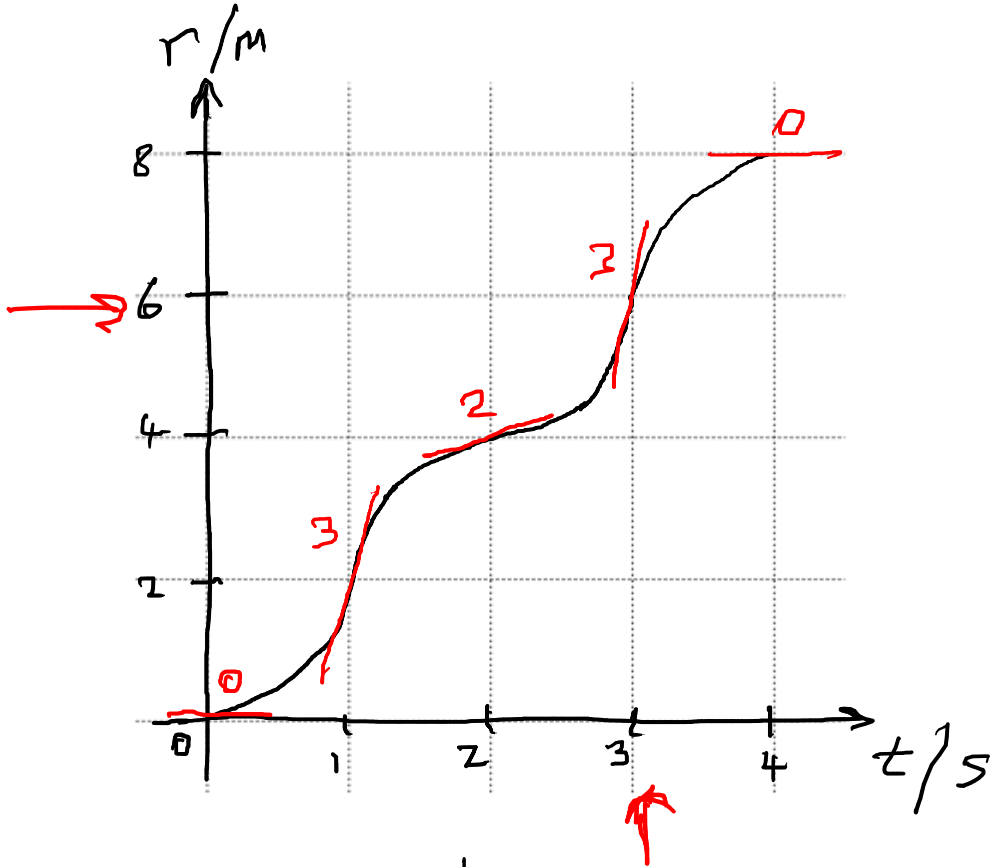


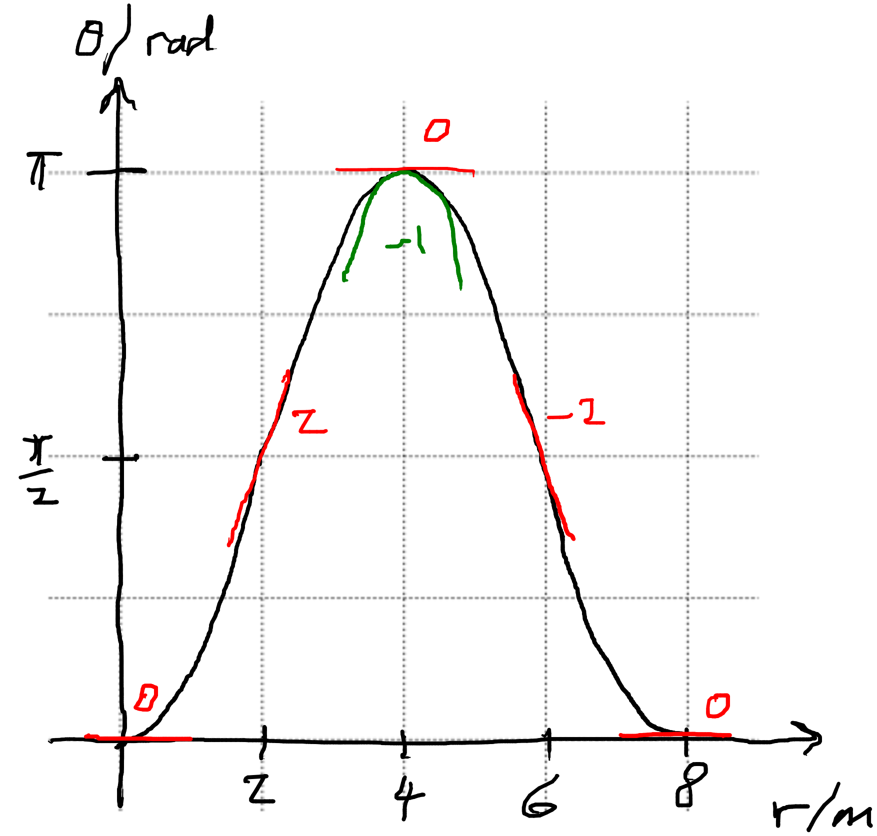
$-r\dot{\theta}$

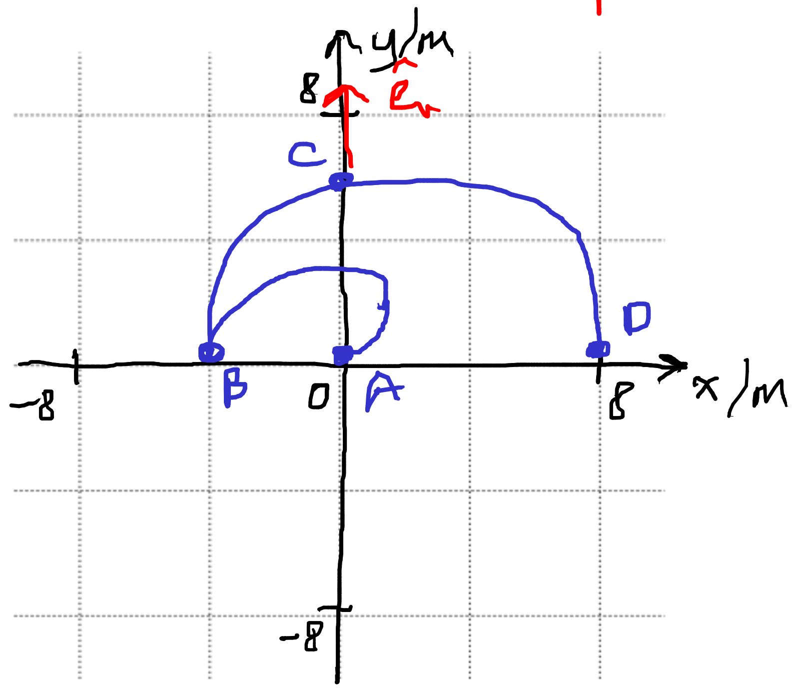
A + C, $\vec{v} = \underline{\boxed{}}\,\hat{i} + \underline{}\,\hat{j}$

A. 36
B. 3
C. 0
D. −3
E. −36

A. $\hat{e}_r$
B. $-\hat{e}_r$
C. $\hat{e}_\theta$
D. $-\hat{e}_\theta$
E. NOTA







At C, $\vec{v} = \_\_\_\_ \hat{i} + \_\_\_\_ \hat{j}$

A. 6

B 3

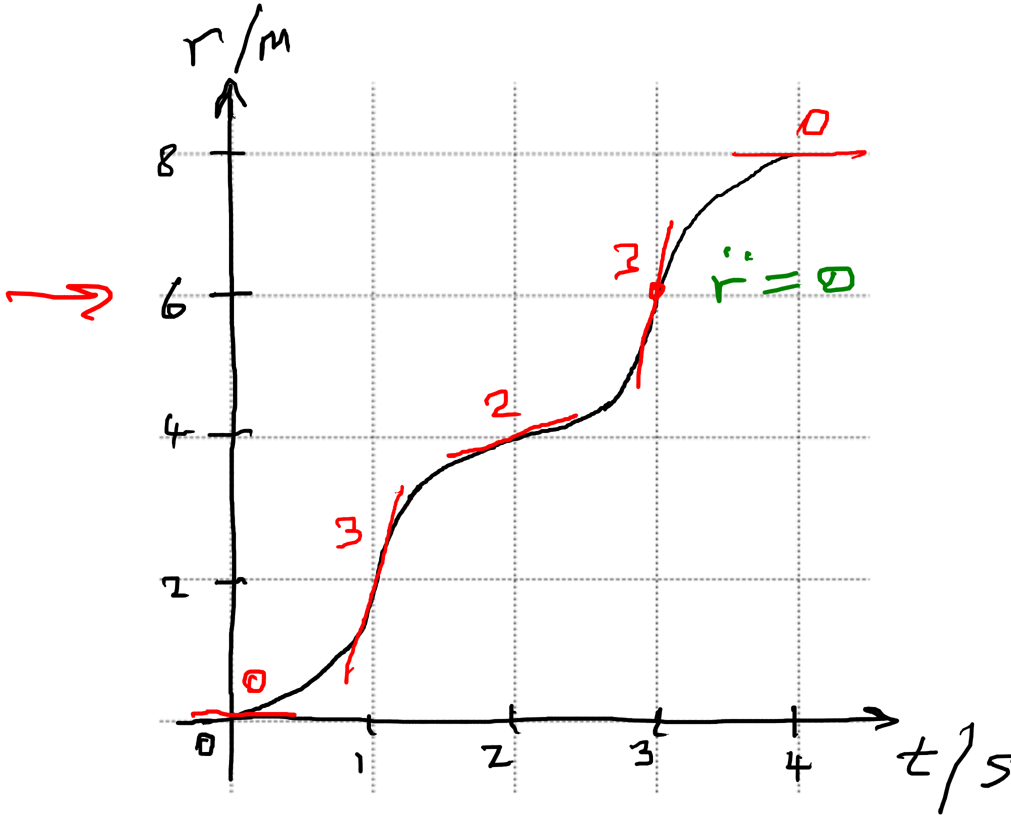
C. 0

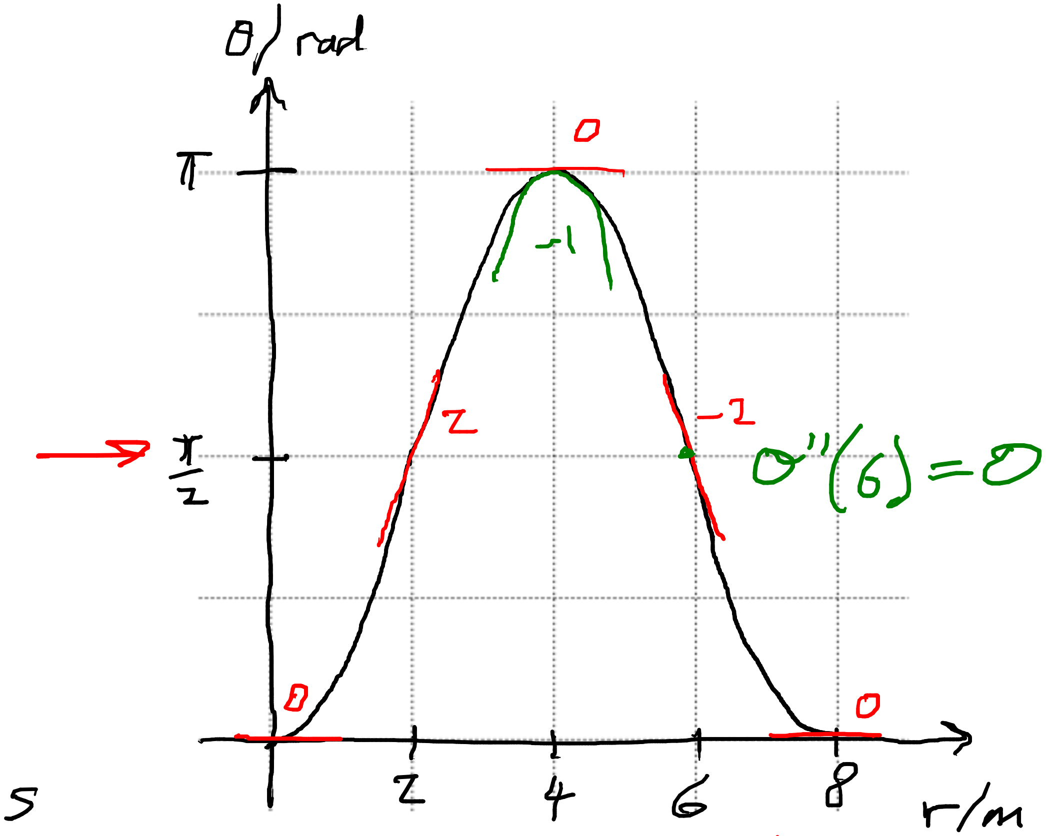
D. -3

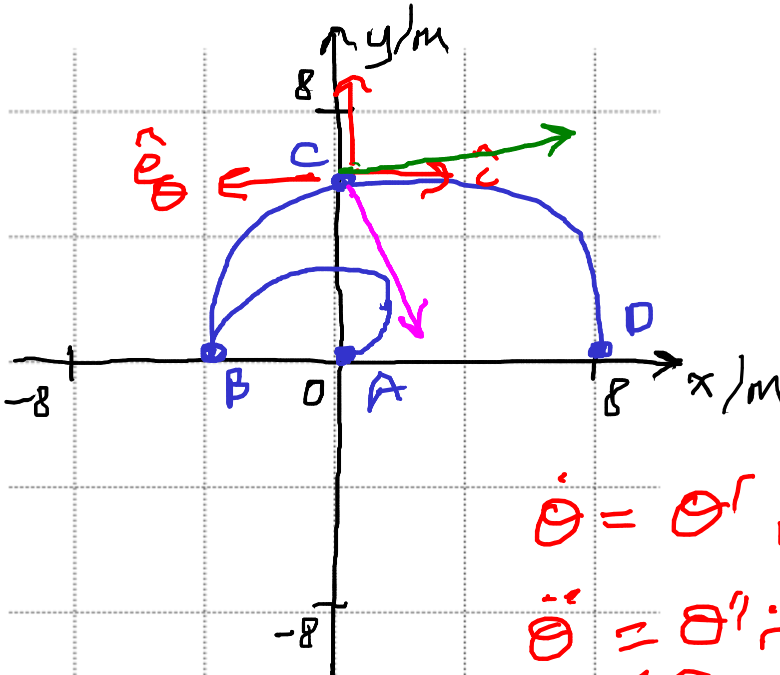
E. -6

$\vec{v} = \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta$

3







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

$$\ddot{\theta} = \theta'' \dot{r}^2 + \theta' \ddot{r} = 0$$

$-(r\ddot{\theta} + 2\dot{r}\dot{\theta})$ $\qquad$ $(\ddot{r} - r\dot{\theta}^2)$

At C, $\vec{a} = \_\_\_\ \hat{c} + \_\_\_\ \hat{j}$

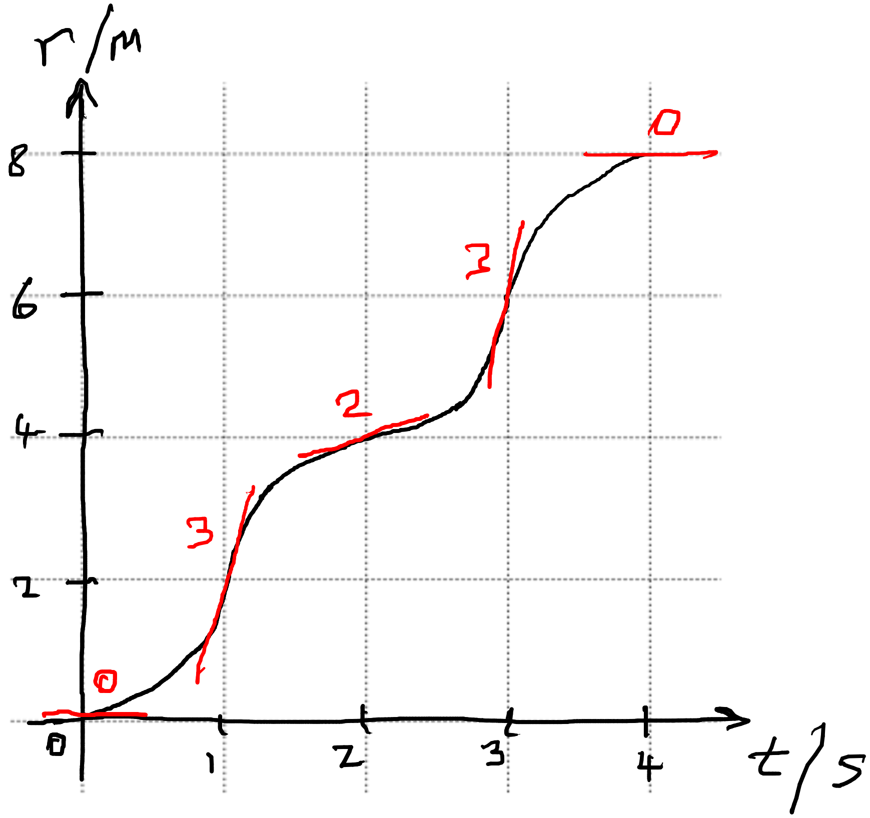
A. 36
B. 6
C. 0
D. -6
E. -36

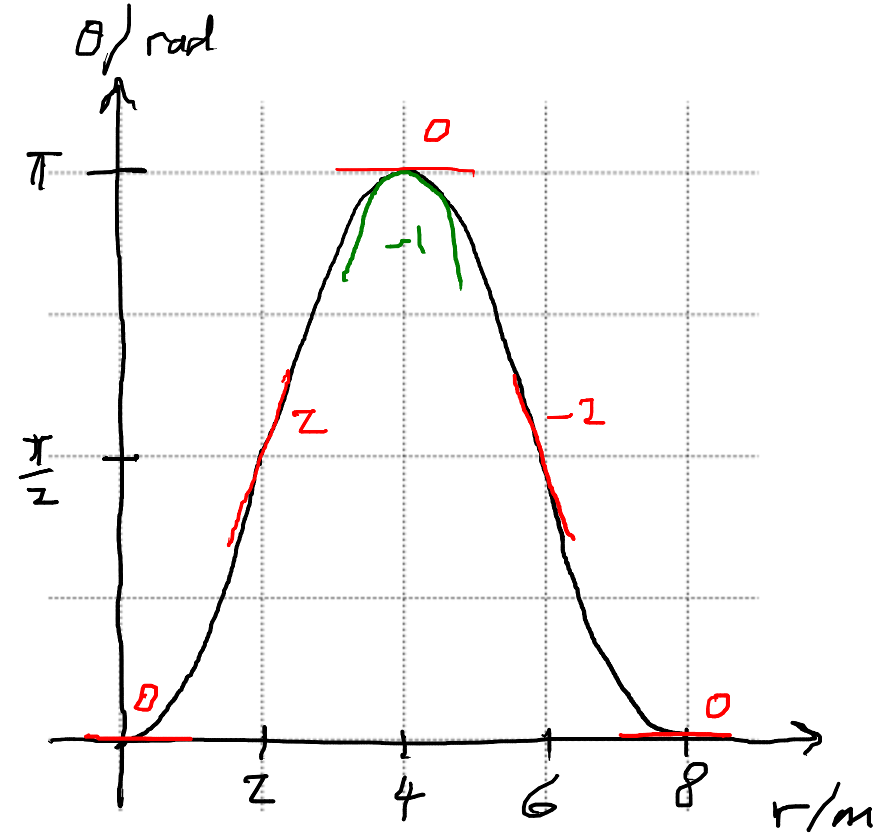
A. 216
B. 24
C. 0
D. -24
E. -216

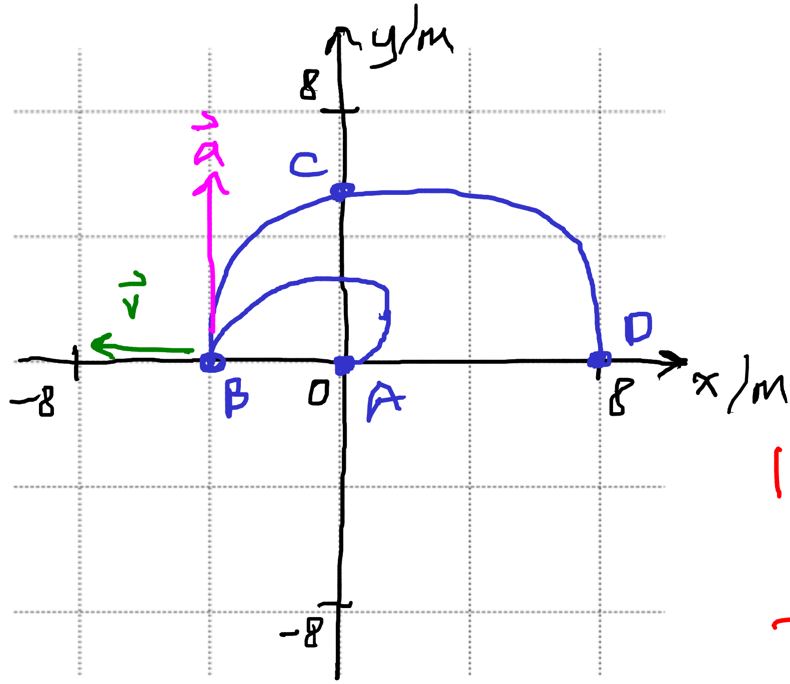
$$\vec{r} = r\hat{e}_r$$

$$\vec{v} = \dot{r}\hat{e}_r + r\dot{\theta}\hat{e}_\theta$$

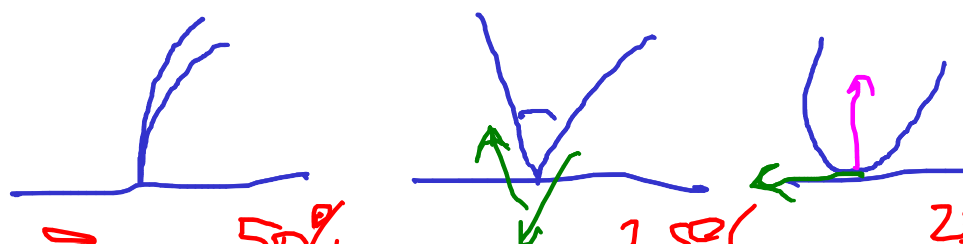
$$\vec{a} = (\ddot{r} - r\dot{\theta}^2)\hat{e}_r + \underline{(r\ddot{\theta} + 2\dot{r}\dot{\theta})}\hat{e}_\theta$$





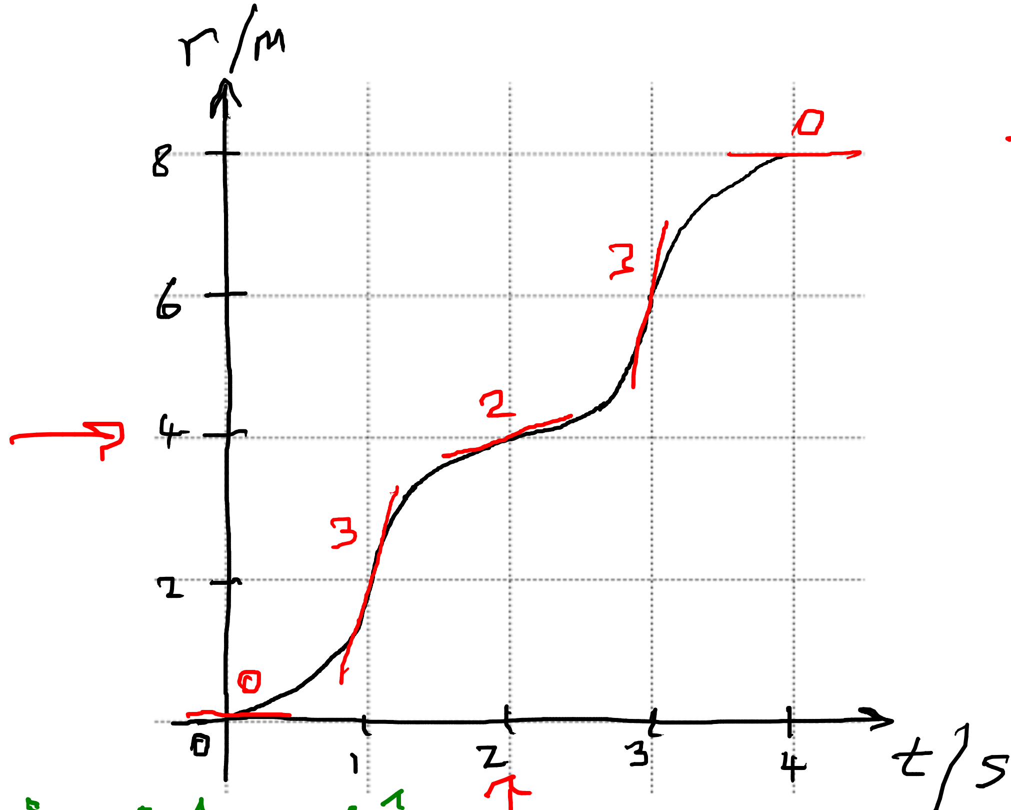


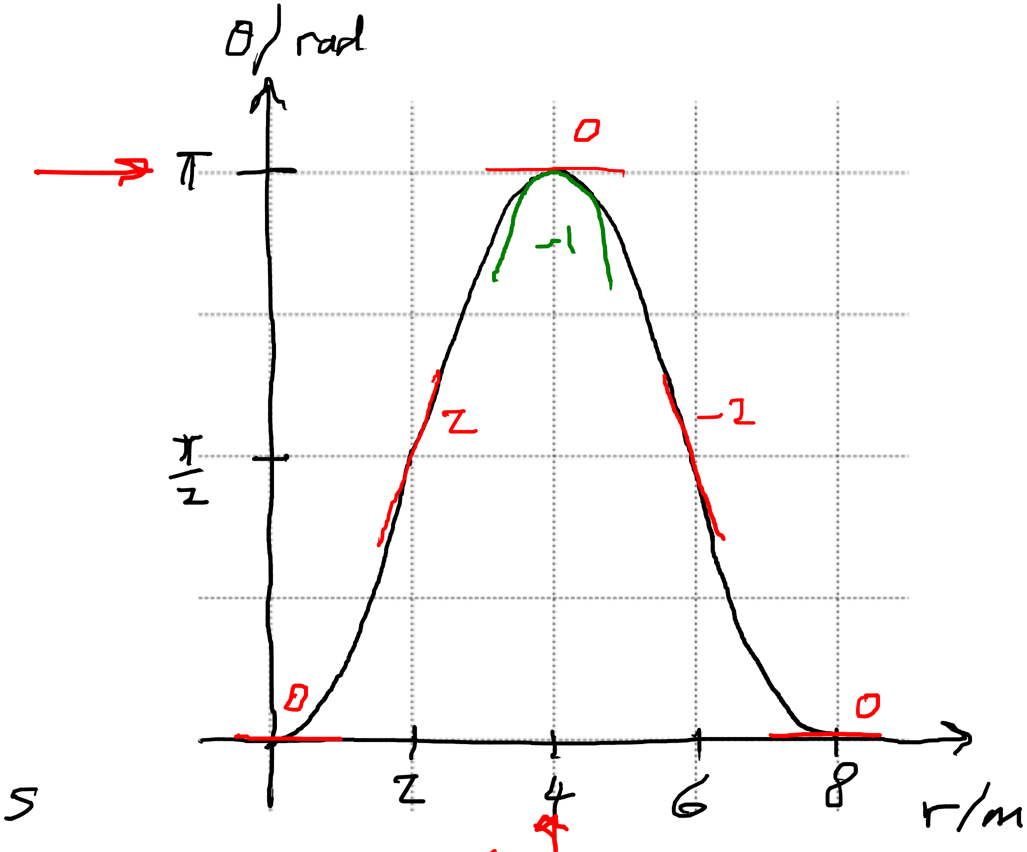
At point B, shape



1st → A 50% B 25% C 25%

2nd → 17 20 $\boxed{63}$

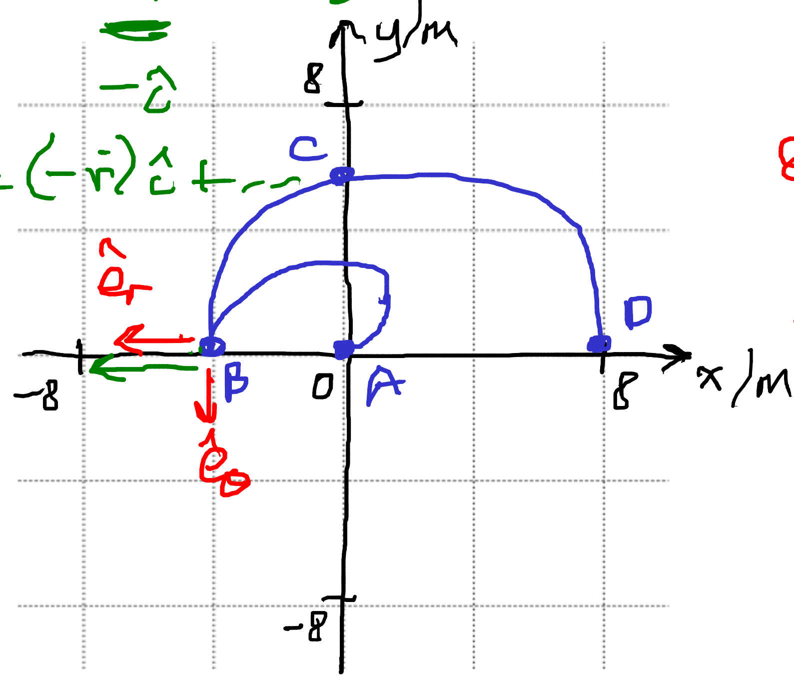




$\vec{v} = \dot{r}\,\hat{e}_r + r\dot{\theta}\,\hat{e}_\theta$

$-\hat{i}$

$\vec{v} = (-\dot{r})\,\hat{i} + --$



$\theta = \pi$

$r = 4$

$t = 2$

$\dot{r} = 2$

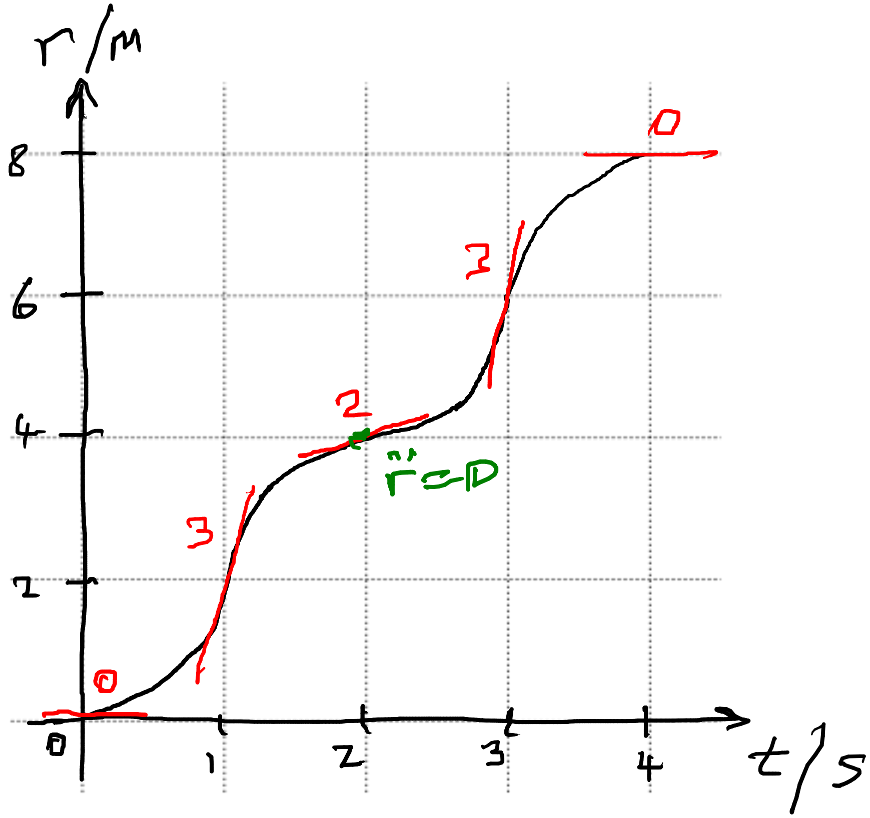
$\dot{\theta} = 0$

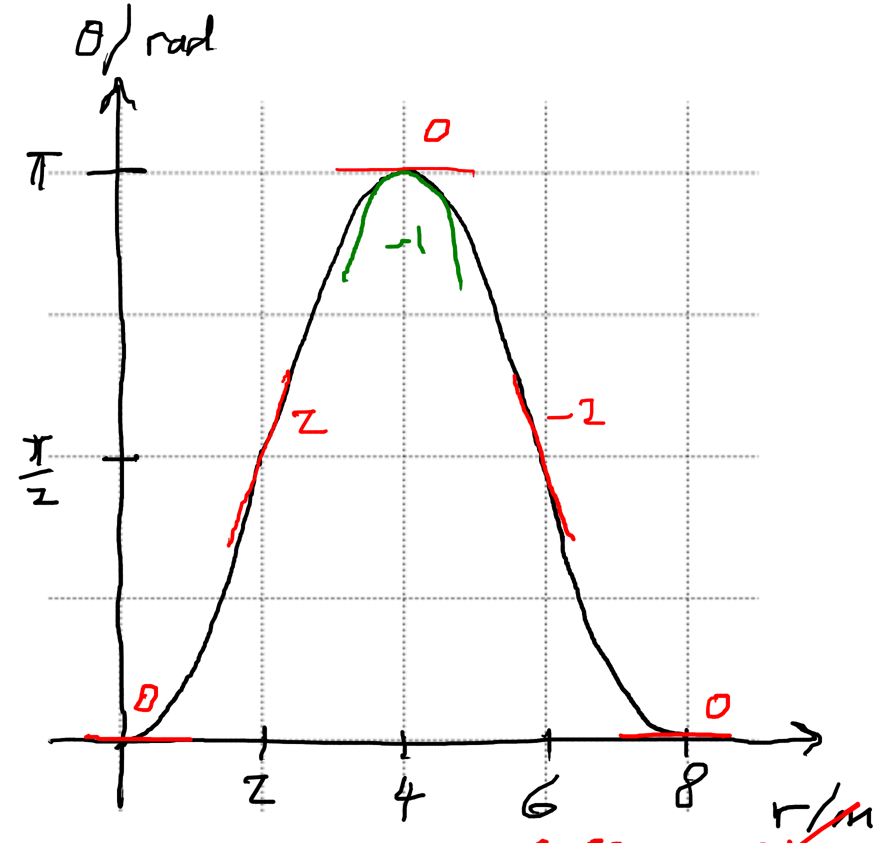
At B, $\vec{v} = \underline{\boxed{}}\,\hat{i} + \underline{\quad\quad}\,\hat{j}$

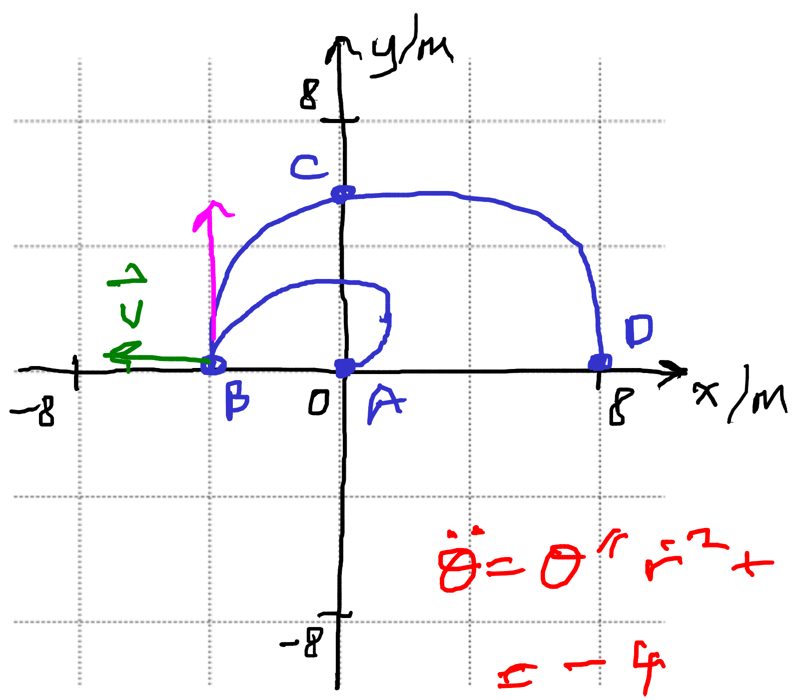
$-\dot{r}$

A. 4
B. 2
C. 0
D. -2
E. -4

A. 4
B. 1
C. 0
D. -2
E. -4







At B, $\vec{a} = \boxed{}\,\hat{i} + \underline{\quad\quad}\,\hat{j}$

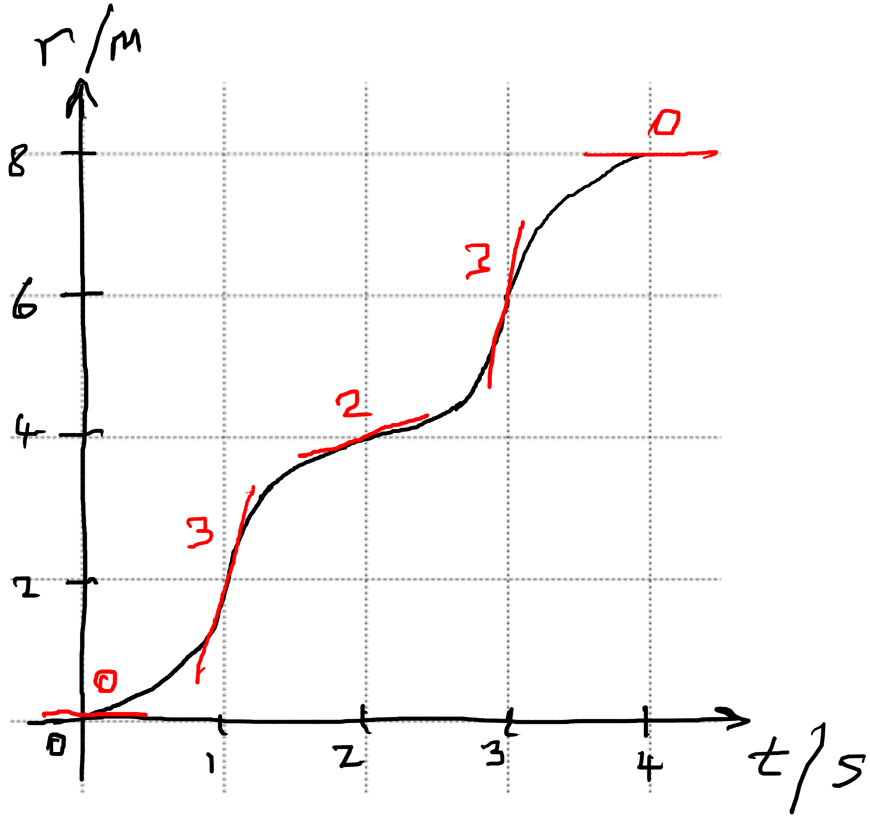
$-(r\ddot{\theta}+\cancel{2\dot{r}\dot{\theta}})$

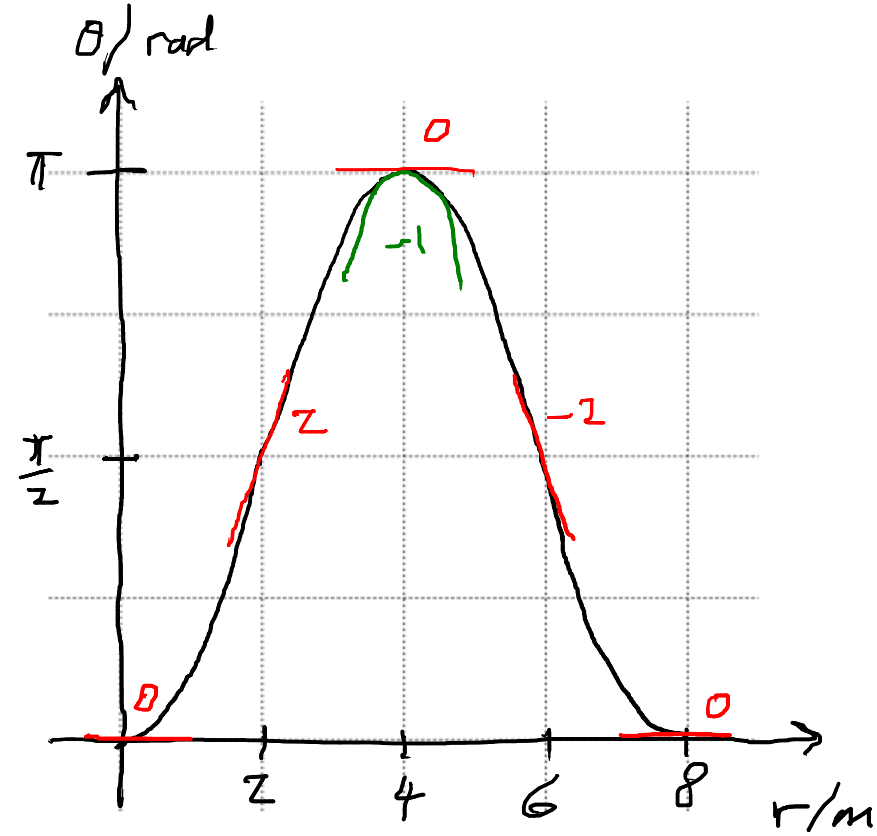
A. 16
B. 4
C. 0
D. −4
E. −16

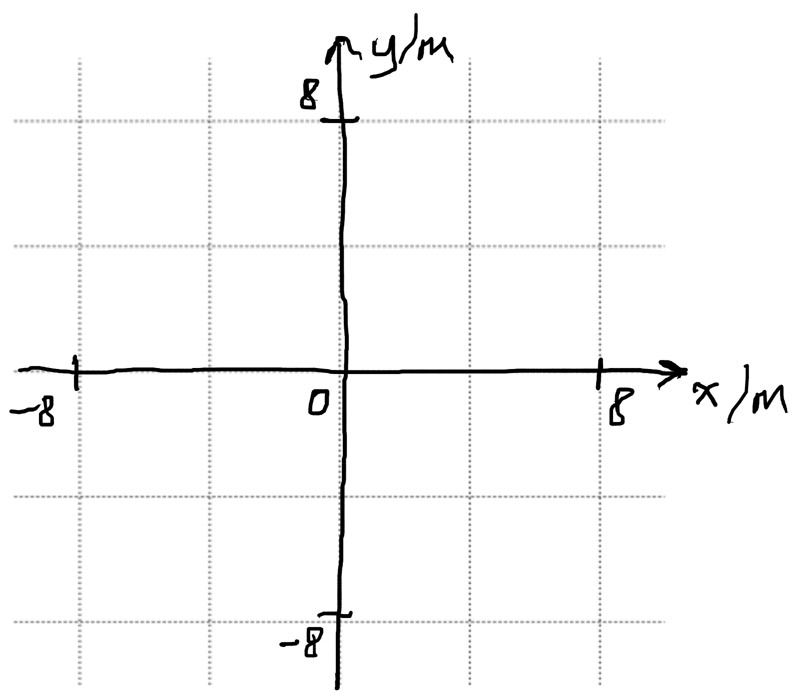
A. 16
B. 4
C. 0
D. −4
E. −16

$\ddot{\theta} = \theta''\dot{r}^2 + \cancel{\theta'\ddot{r}}$

$= -4$


r/m
t/s
8
6
4
2
0
1
2
3
4
0
3
2
3
0


θ/rad
r/m
π
π/2
2
4
6
8
0
-1
2
-2
0
0


y/m
x/m
8
-8
-8
0
8