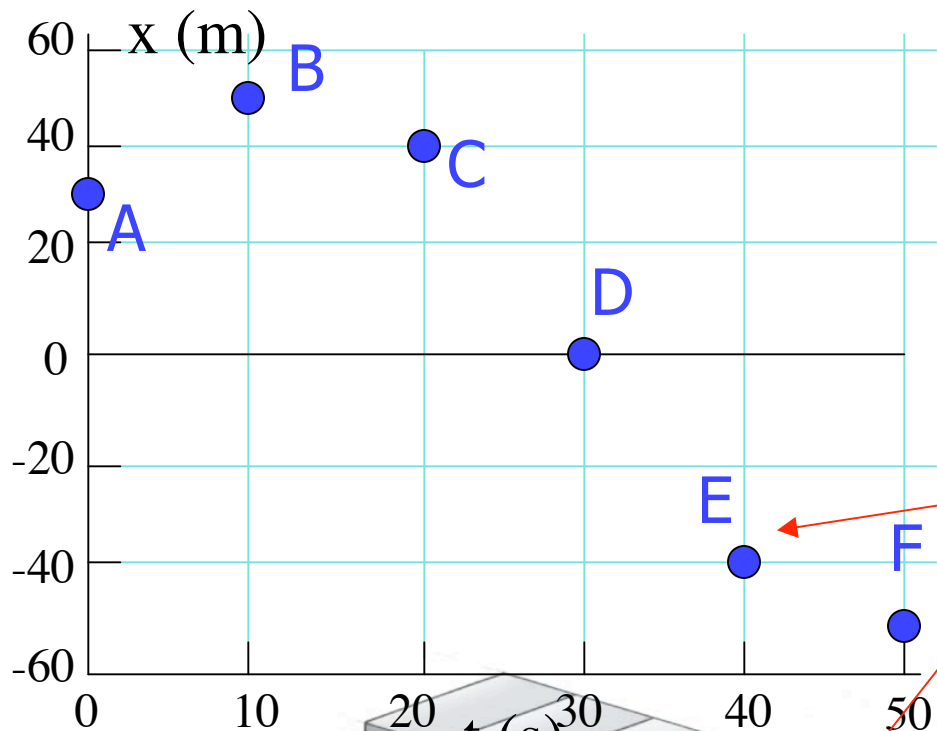
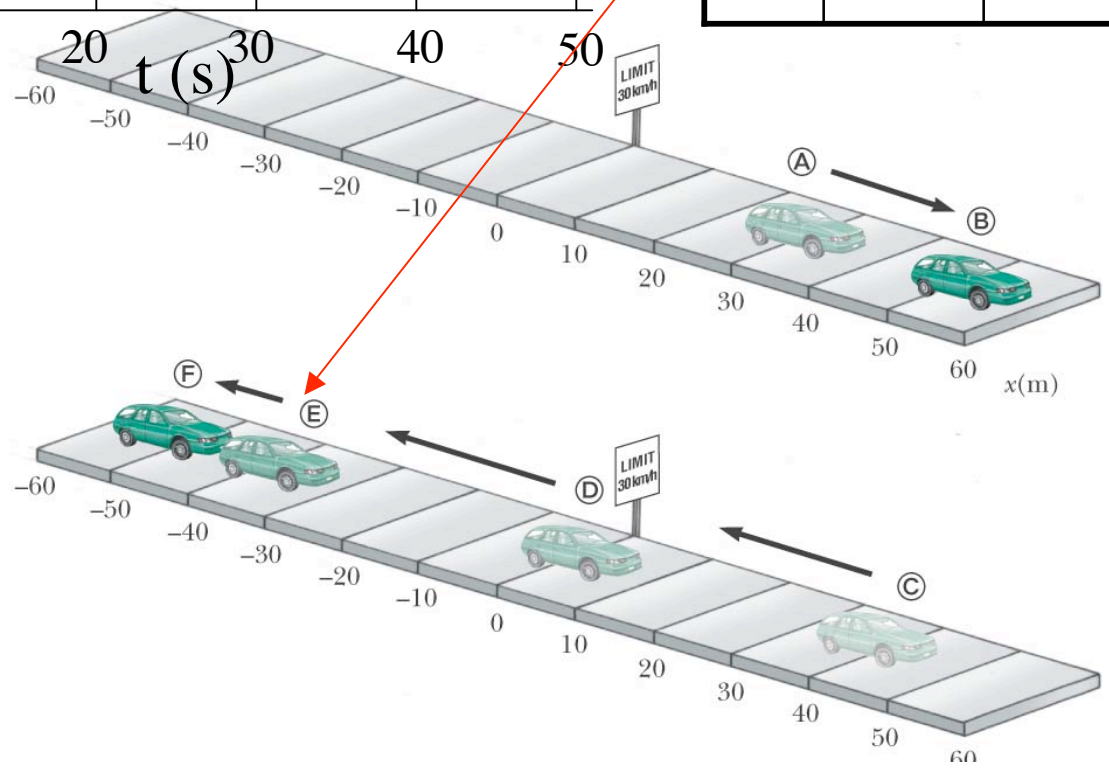
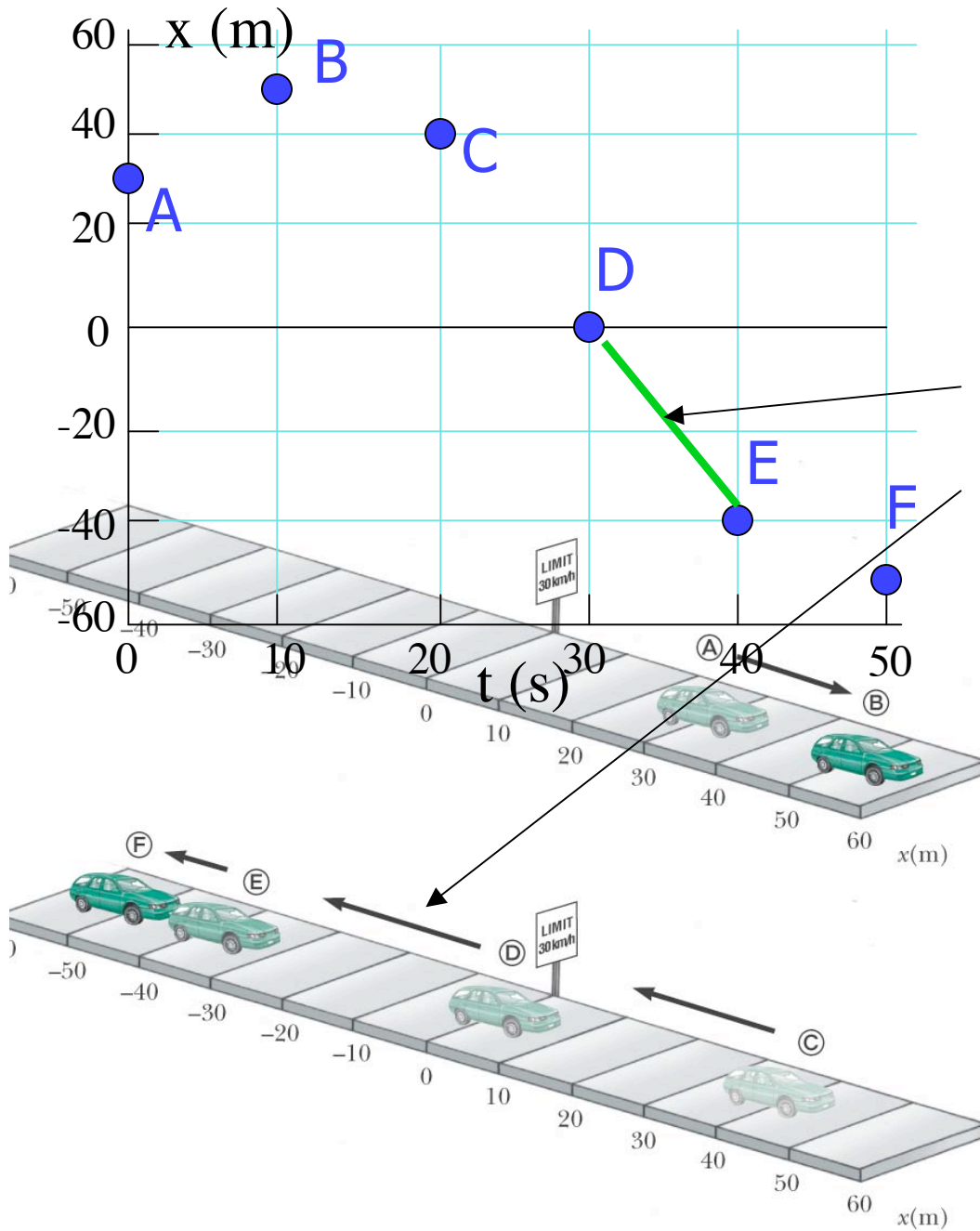


# Motion in One Dimension



	t (s)	x (m)
A	0	30
B	10	50
C	20	40
D	30	0
E	40	-40
F	50	-50





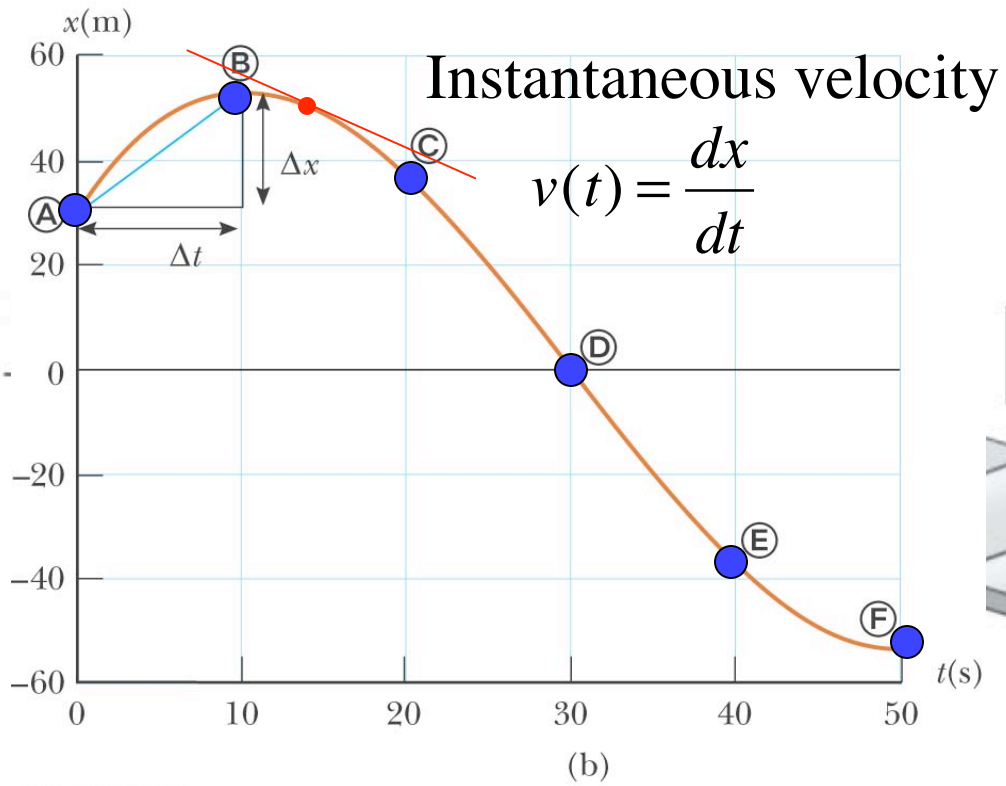
	t (s)	x (m)
A	0	30
B	10	50
C	20	40
D	30	0
E	40	-40
F	50	-50

$$\Delta x = x_{\text{final}} - x_{\text{initial}}$$

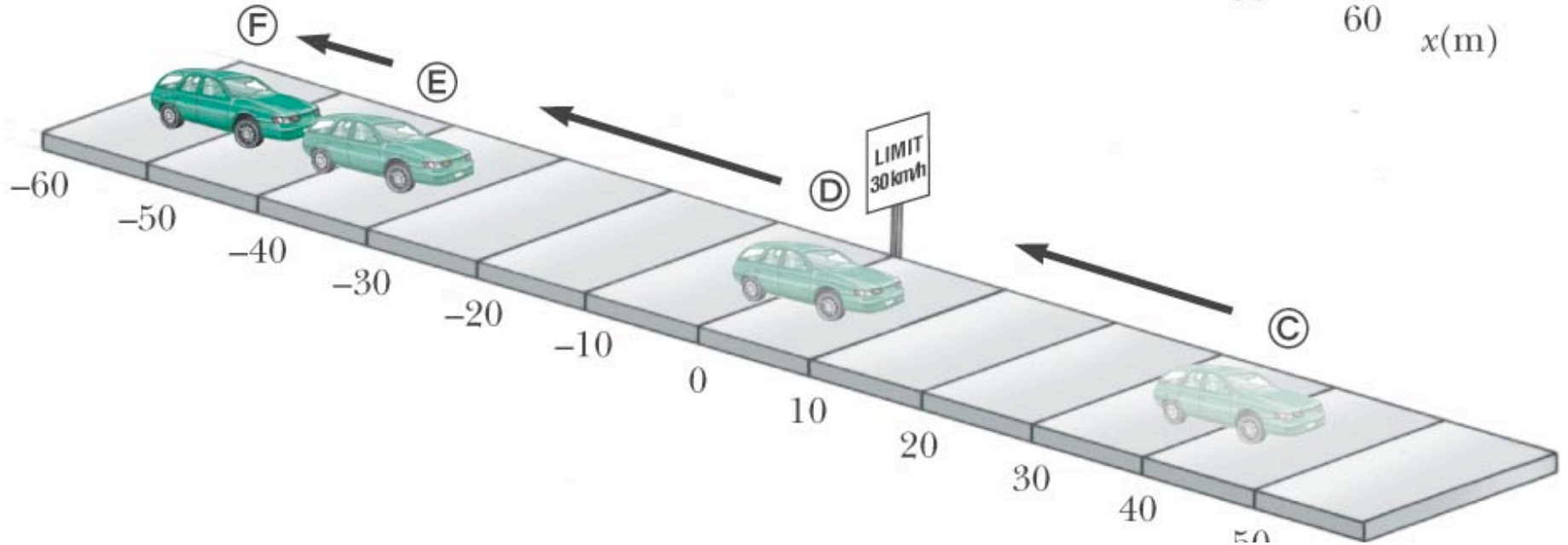
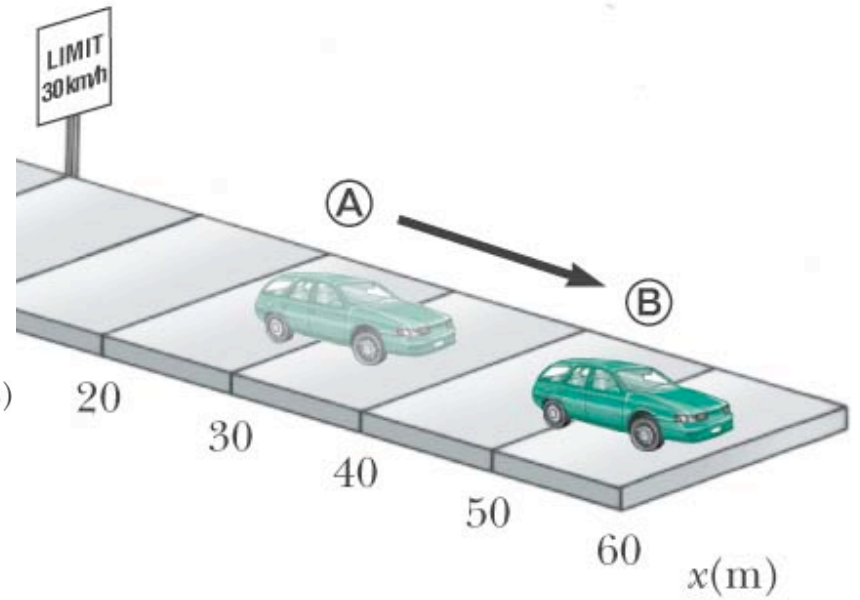
$$= -40\text{m} - 0\text{m} = -40\text{ m}$$

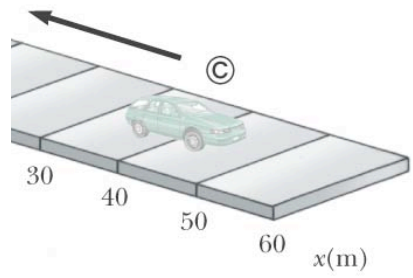
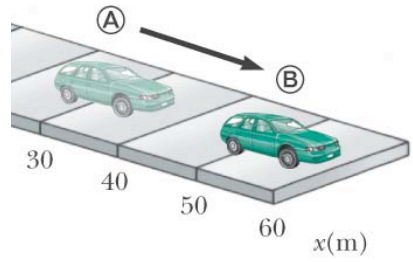
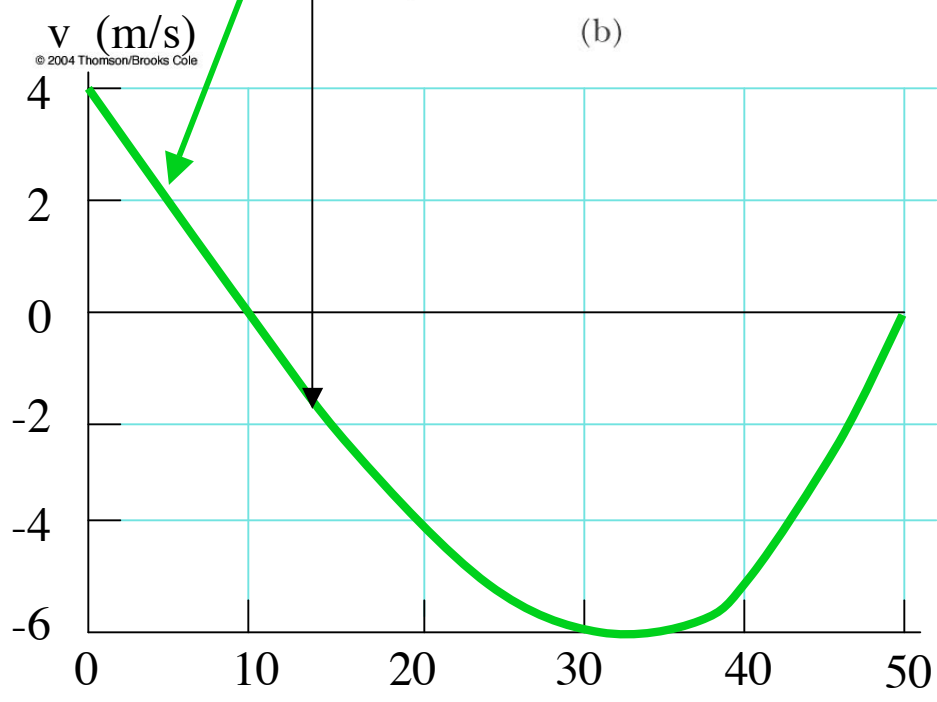
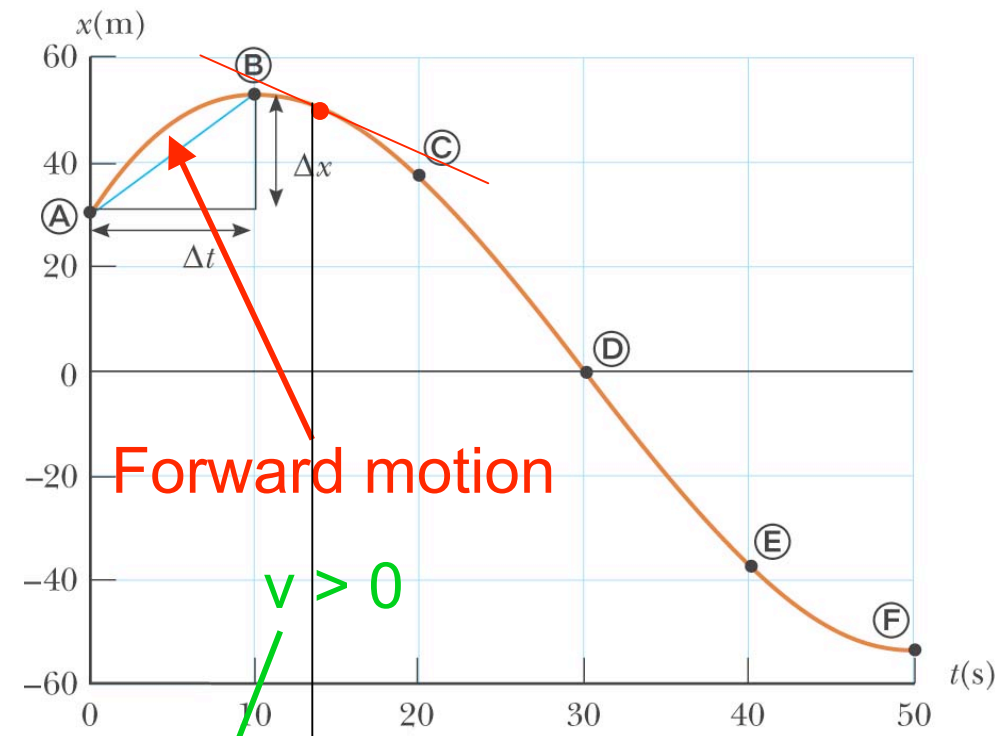
$$\Delta x / \Delta t = -40\text{ m} / 10\text{ s}$$

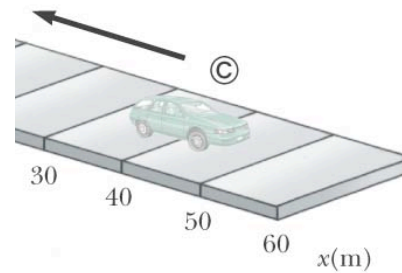
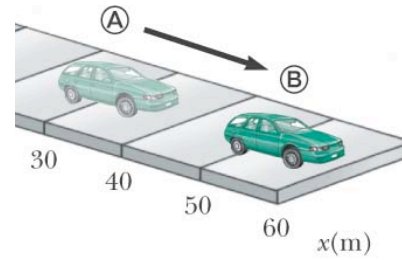
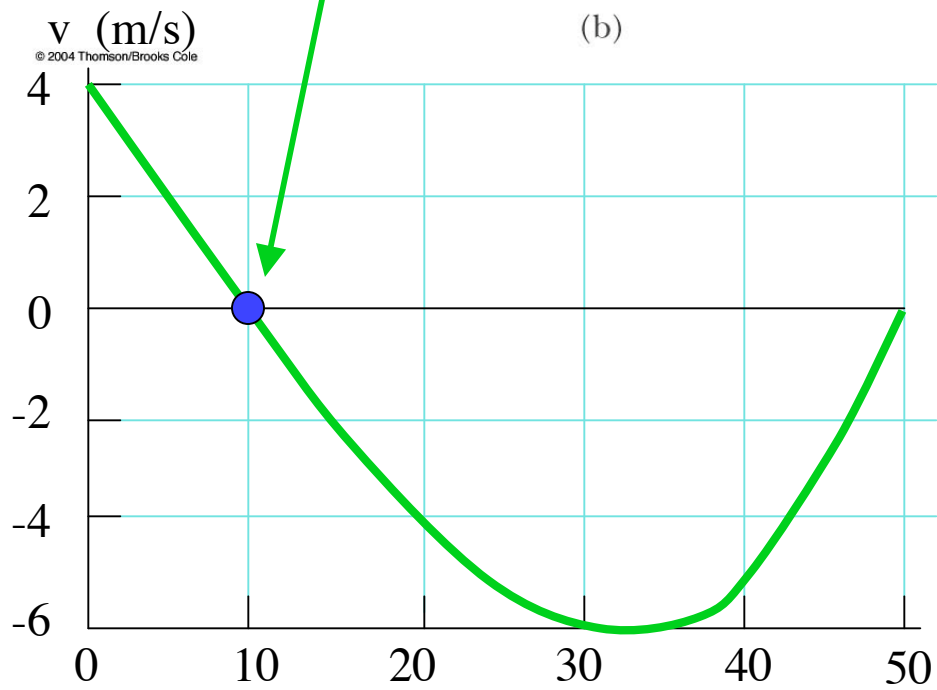
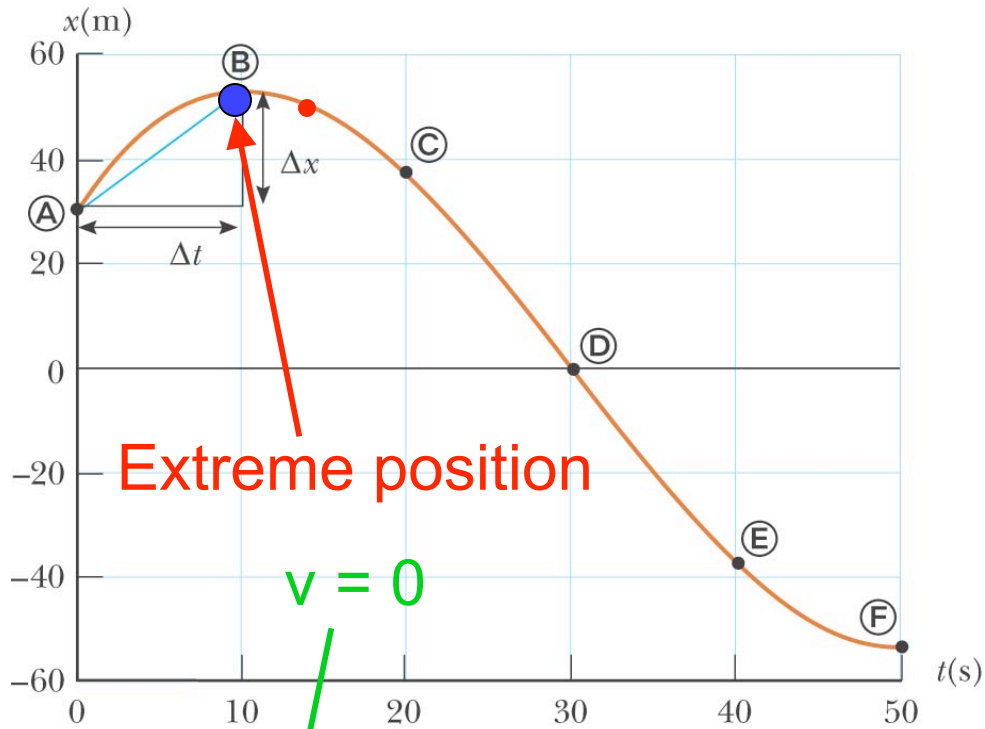
$$= -4\text{ m/s}$$

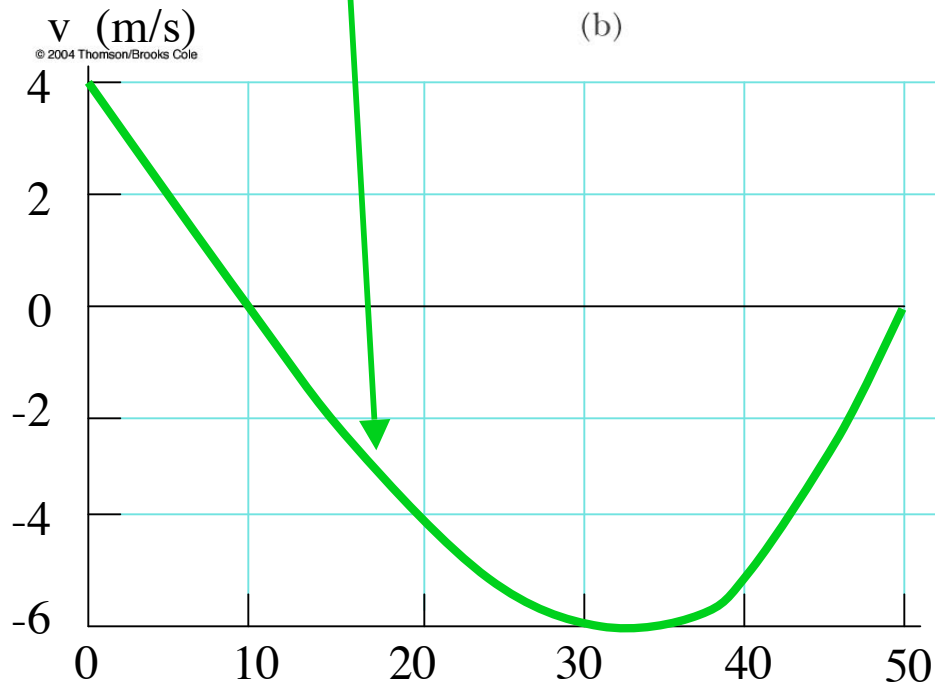
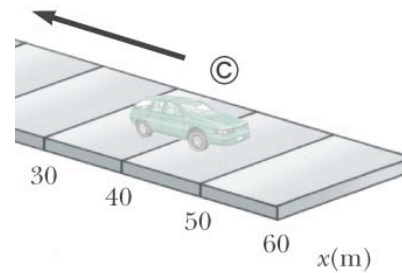
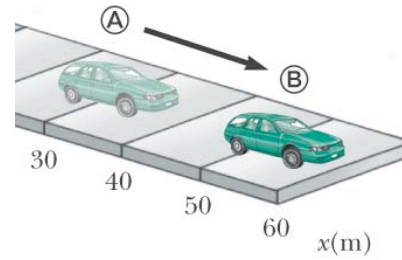
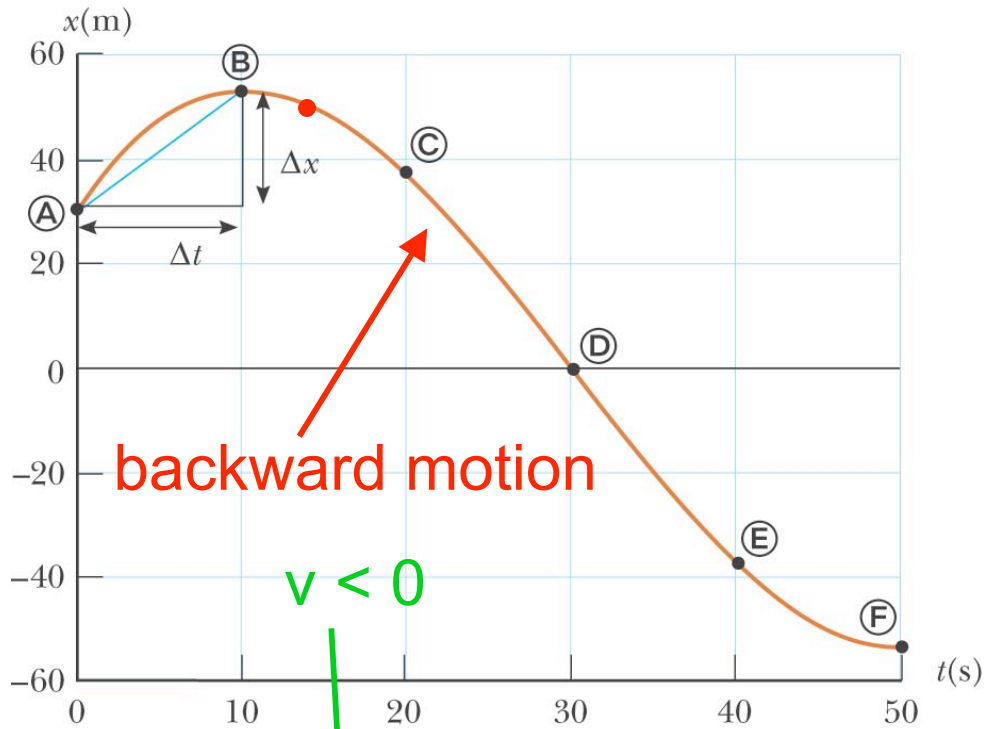


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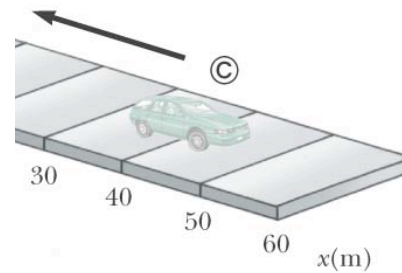
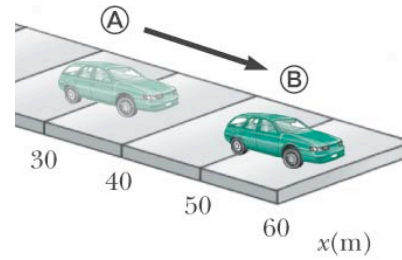
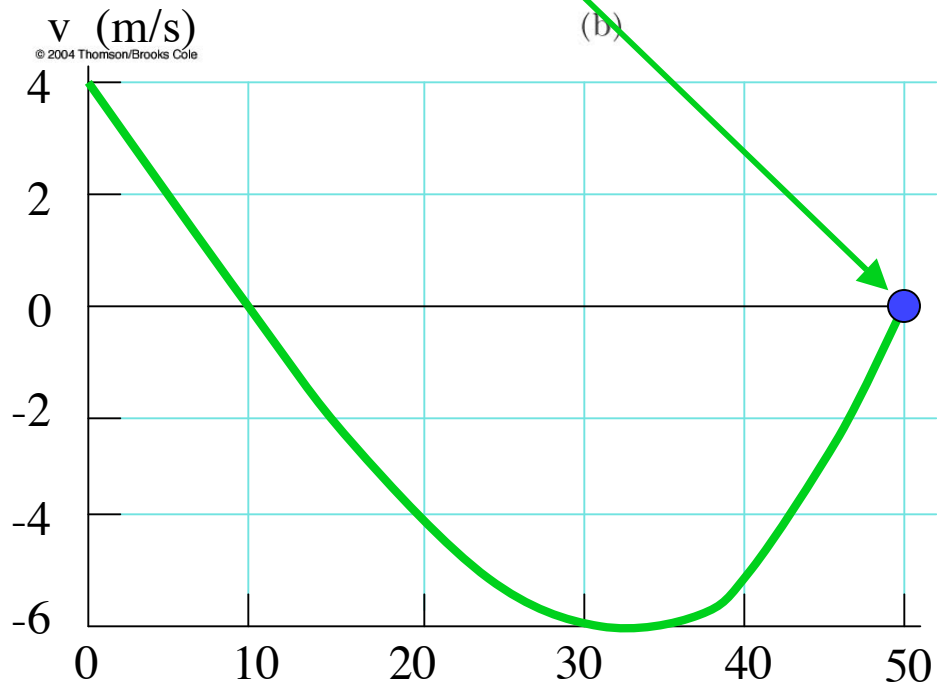
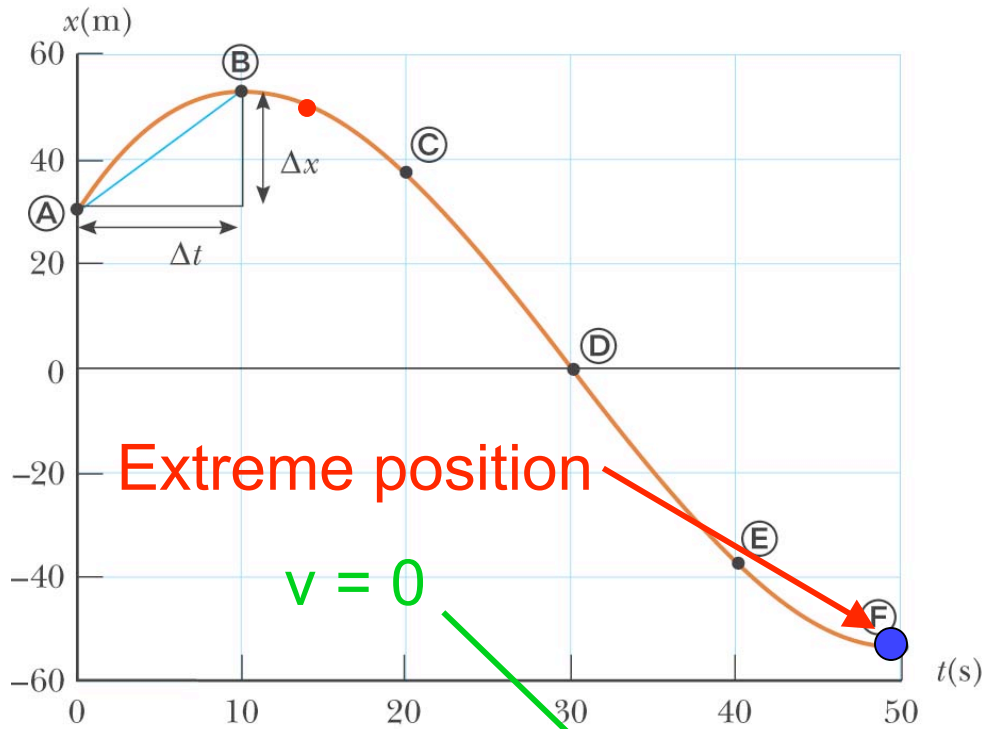


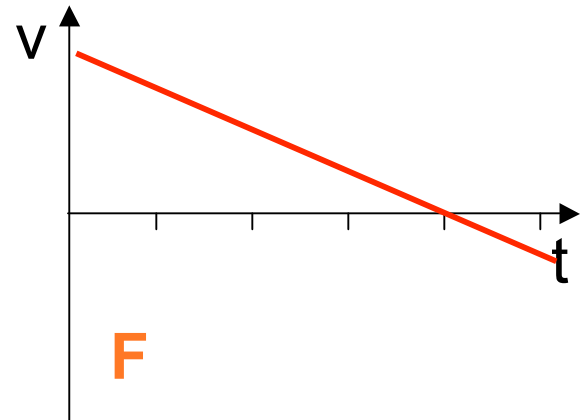
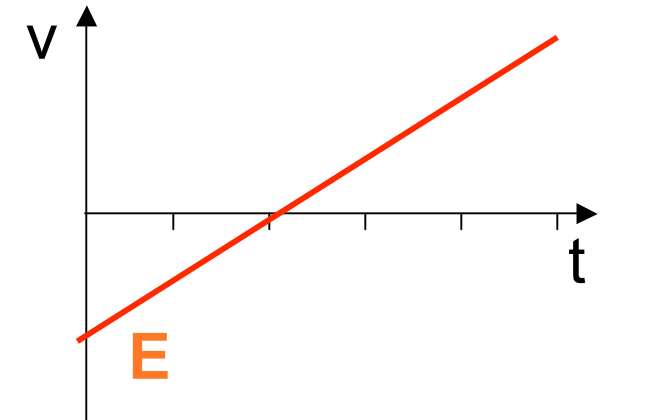
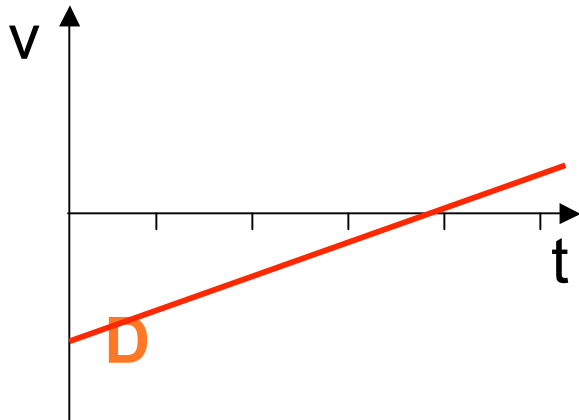
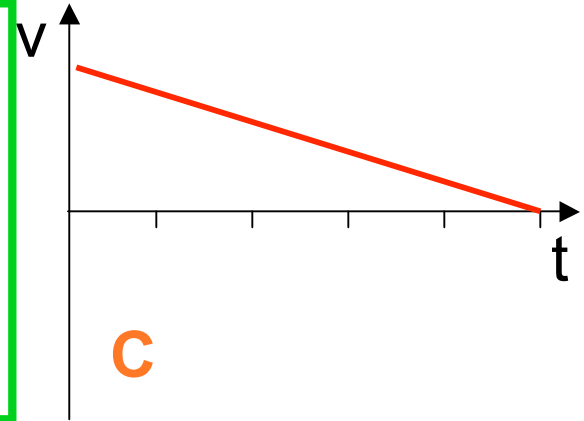
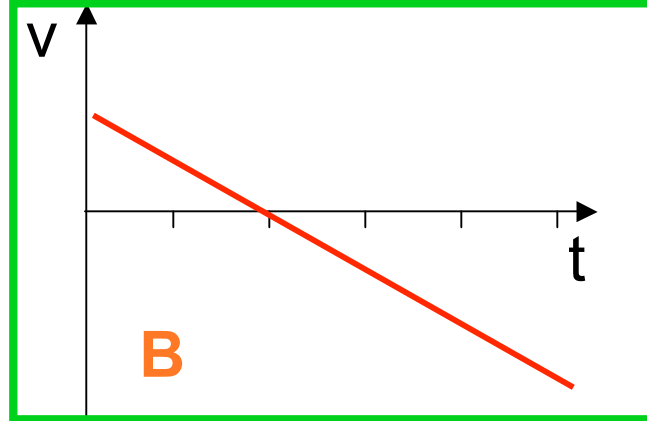
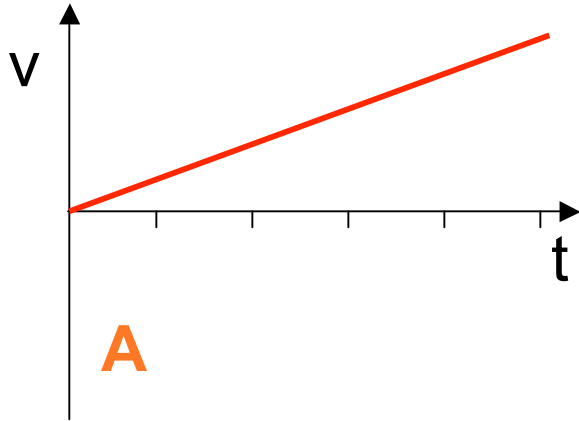
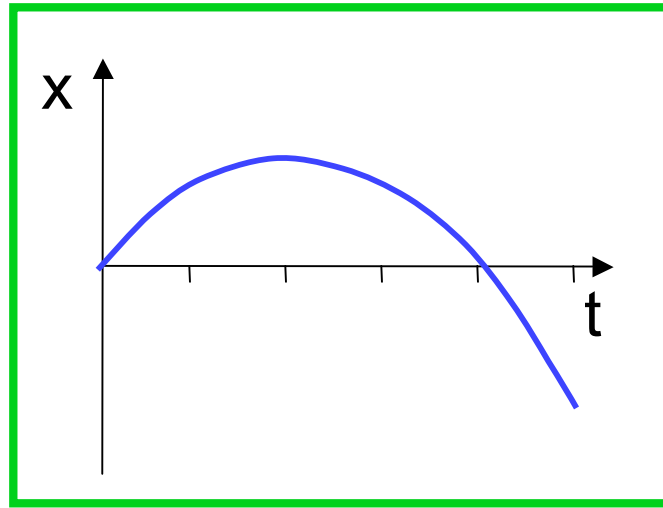


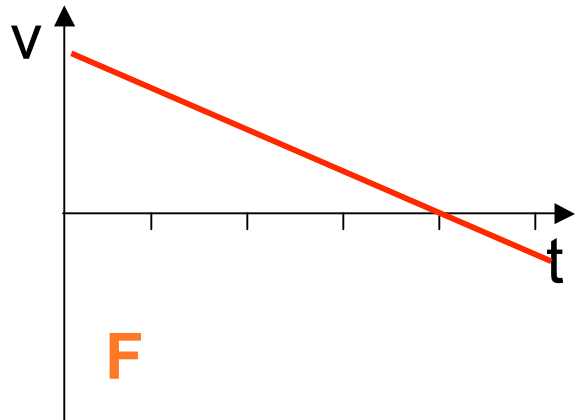
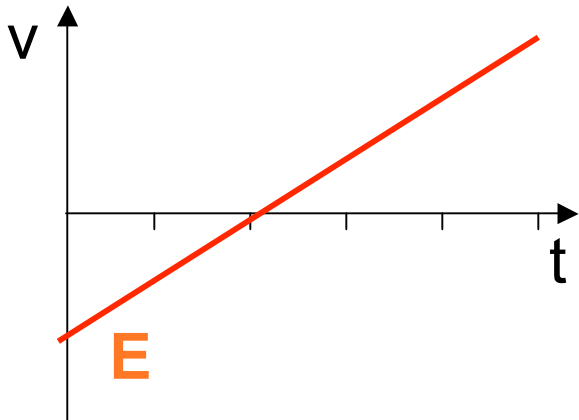
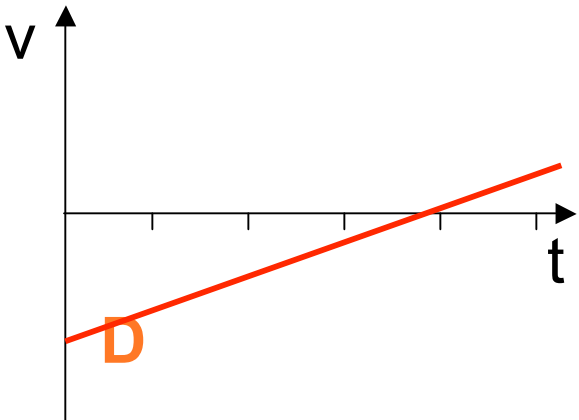
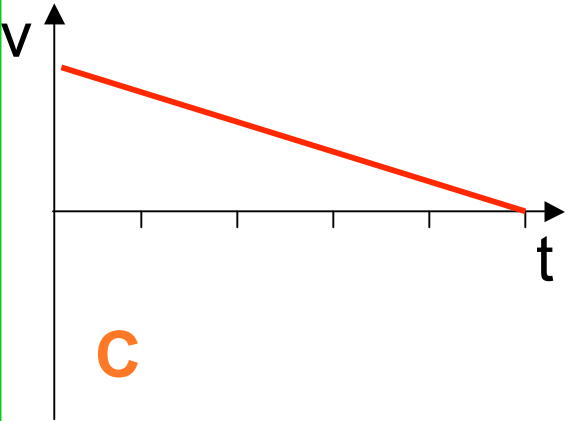
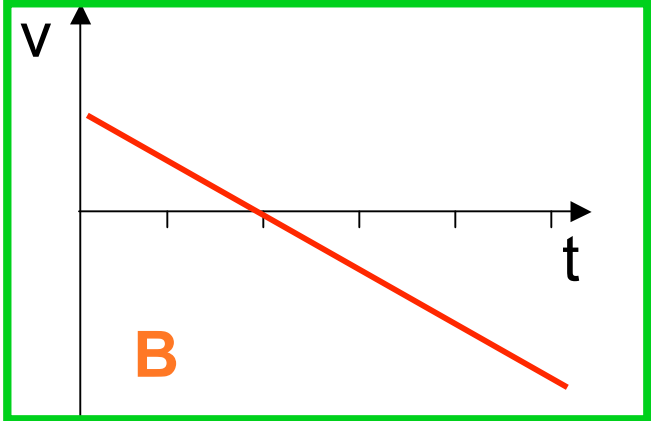
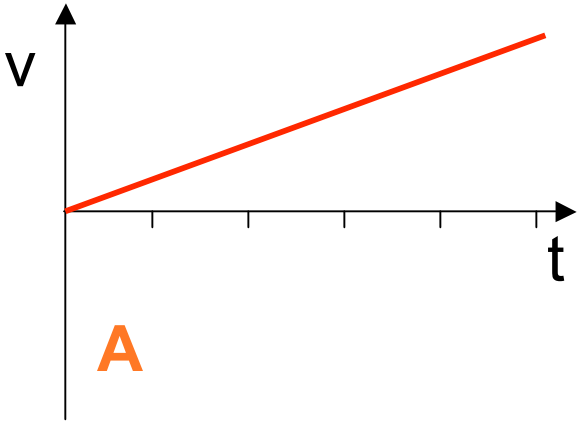
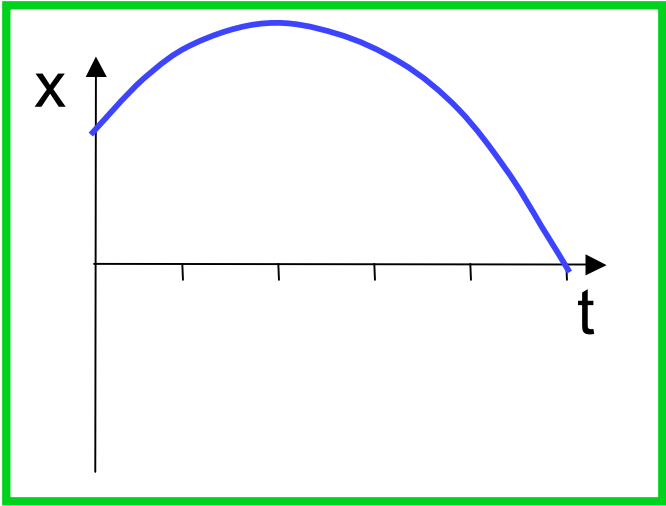


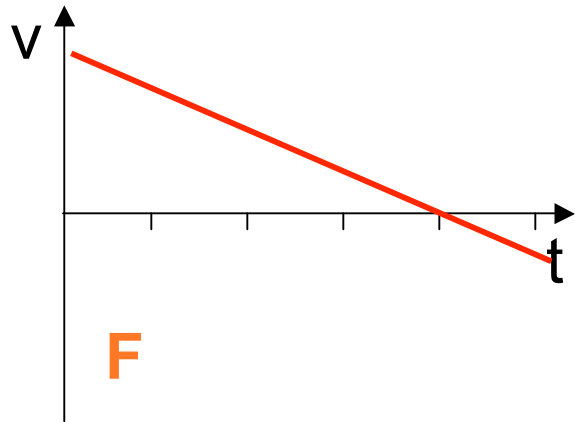
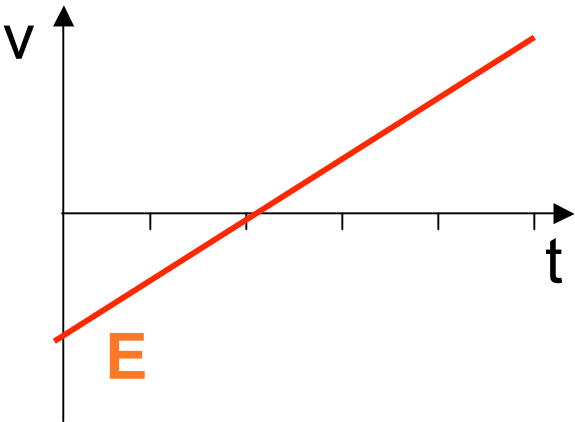
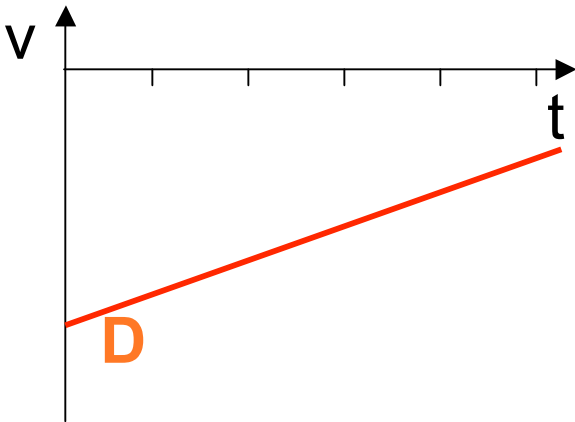
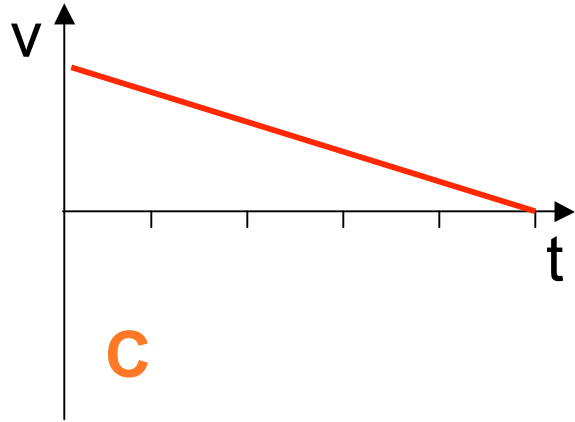
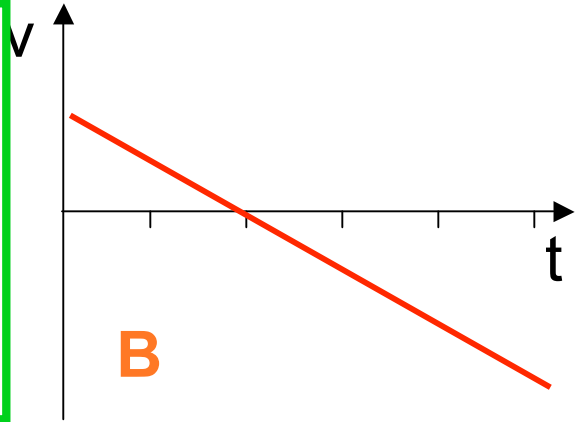
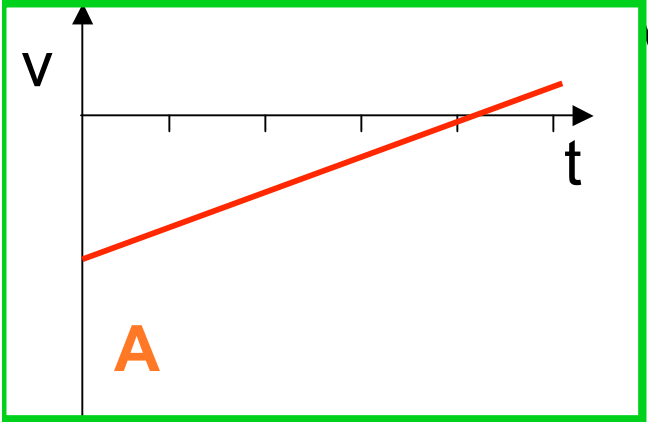
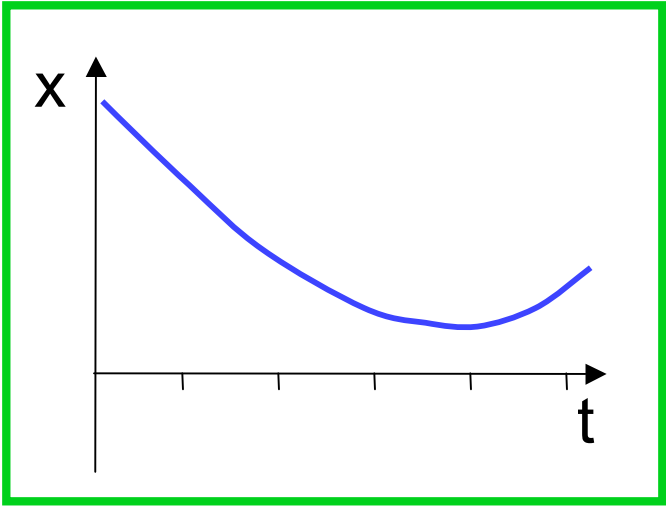


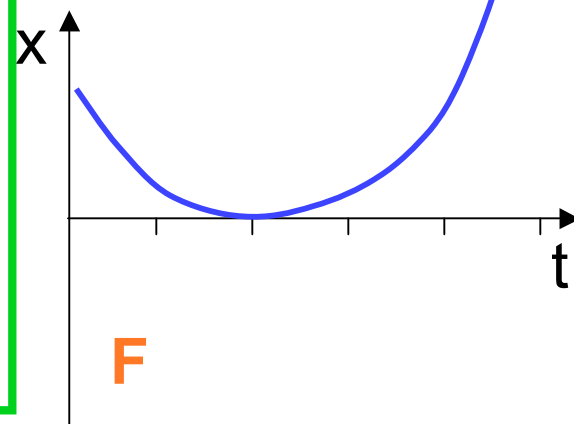
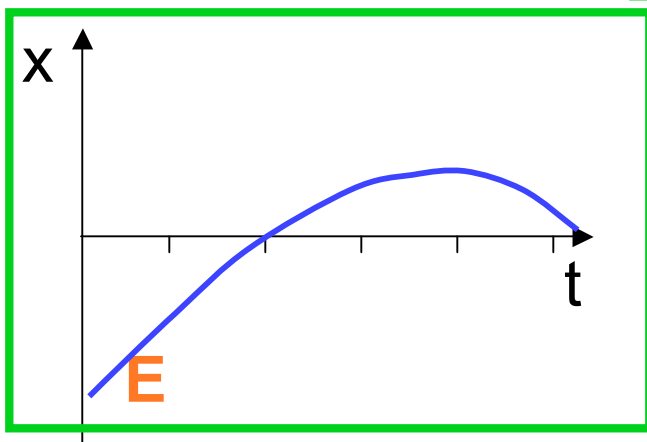
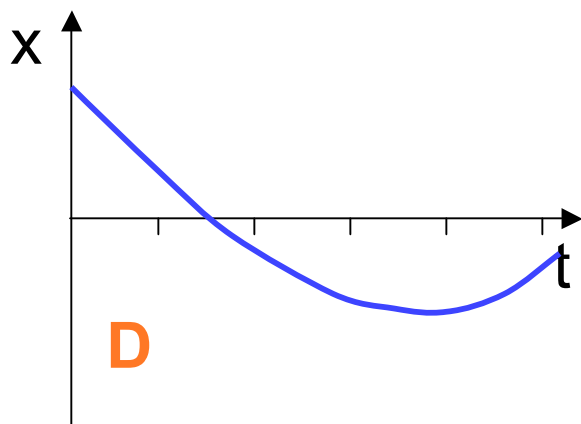
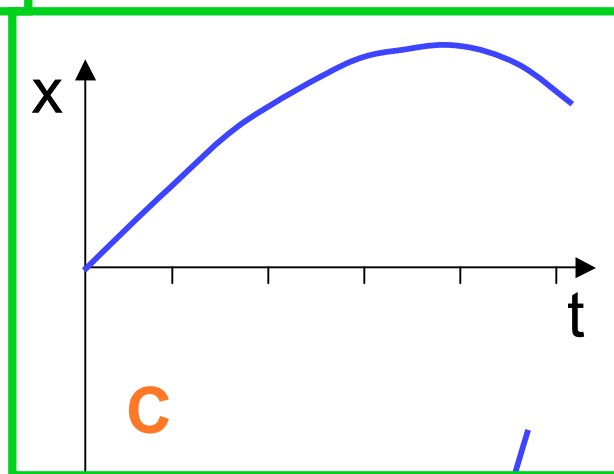
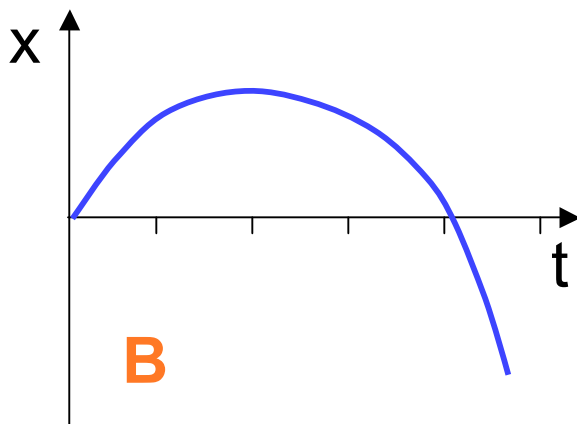
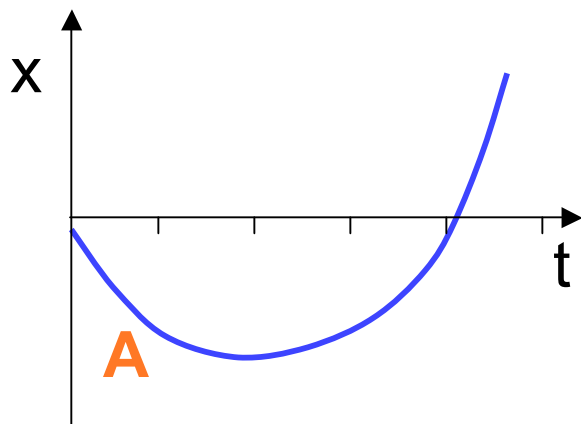
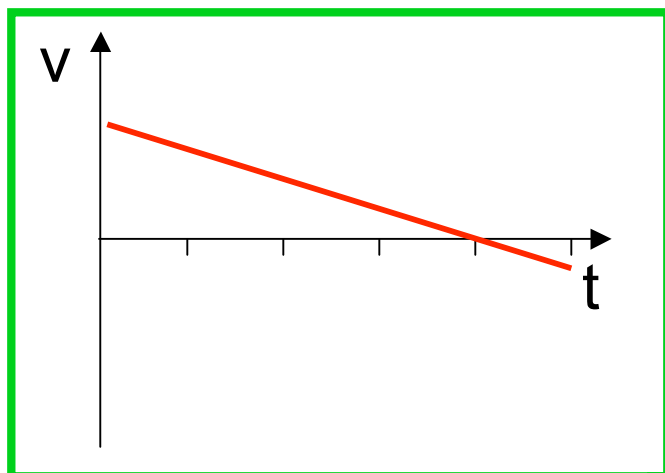
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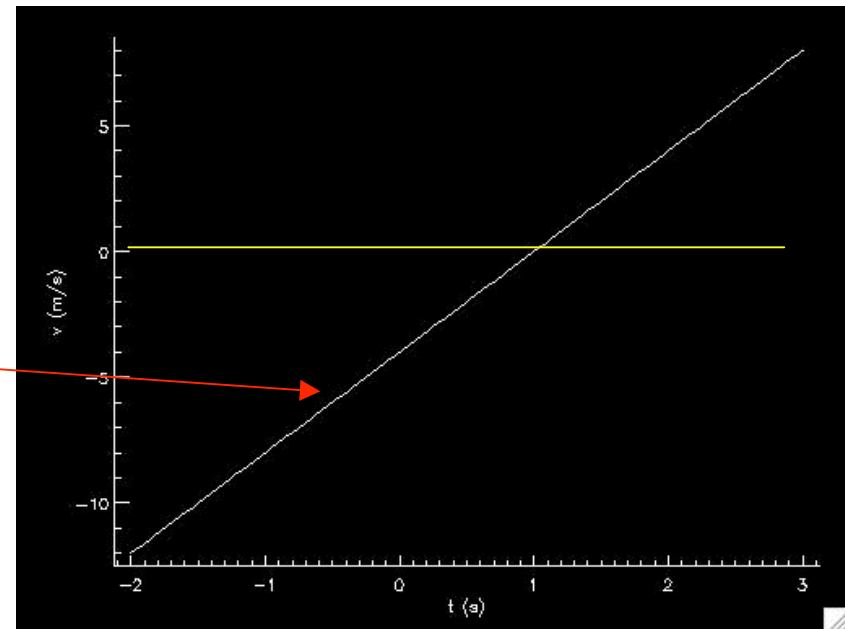
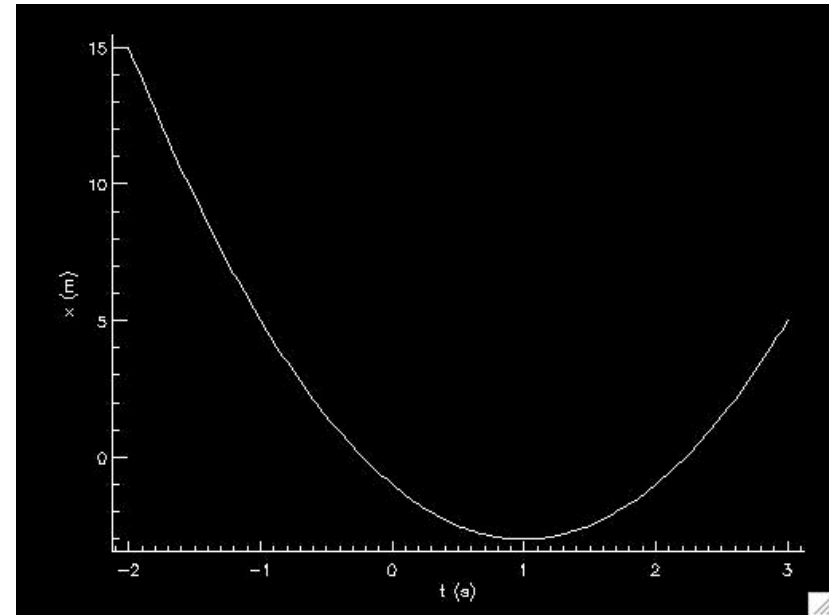


# Analytic positions

$$x(t) = 2t^2 - 4t - 1$$

Q: what is  $v(t)$ ?

$$v(t) = \frac{dx}{dt} = 4t - 4$$



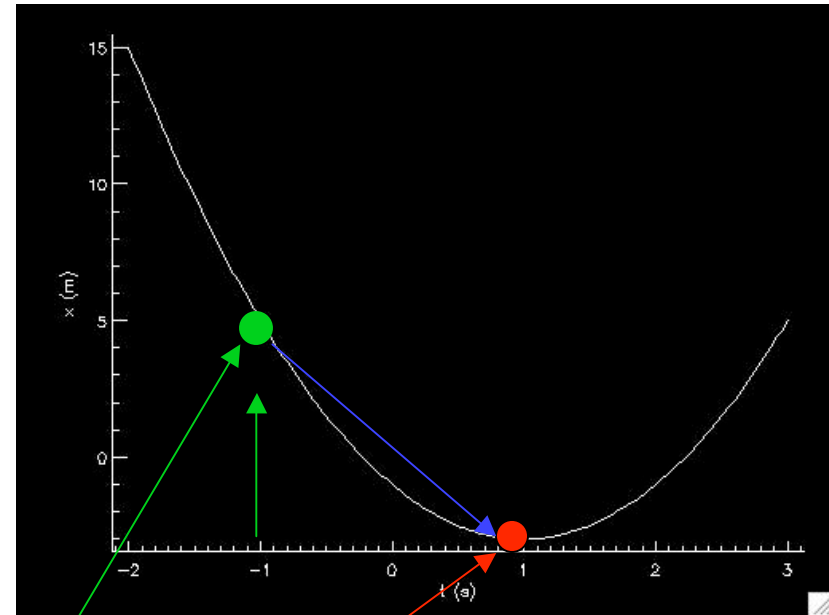
# Analytic positions

$$x(t) = 2t^2 - 4t - 1$$

Q: what is avg. vel.  
between  $t=-1$  &  $t=1$ ?

$$\Delta x = x(1) - x(-1) = \boxed{-3} - \boxed{5} = -8$$

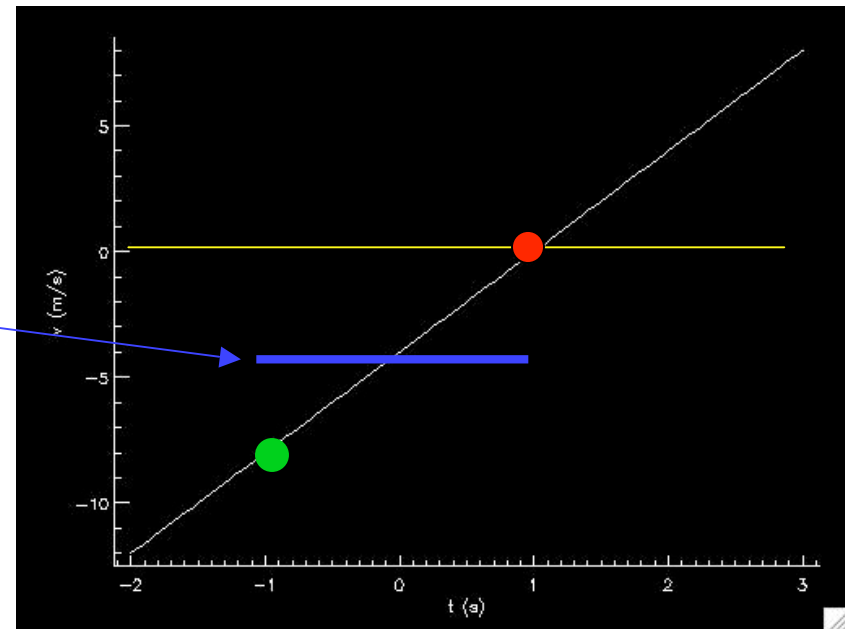
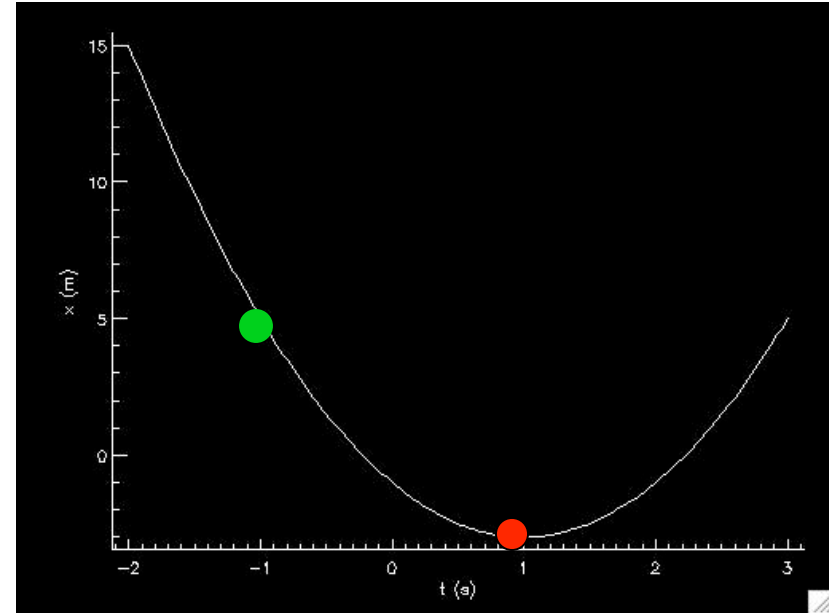
$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{-8}{2} = -4 \text{ m/s}$$



# Analytic positions

$$x(t) = 2t^2 - 4t - 1$$

$$\bar{v} = \frac{\Delta x}{\Delta t} = \frac{-8}{2} = -4 \text{ m/s}$$



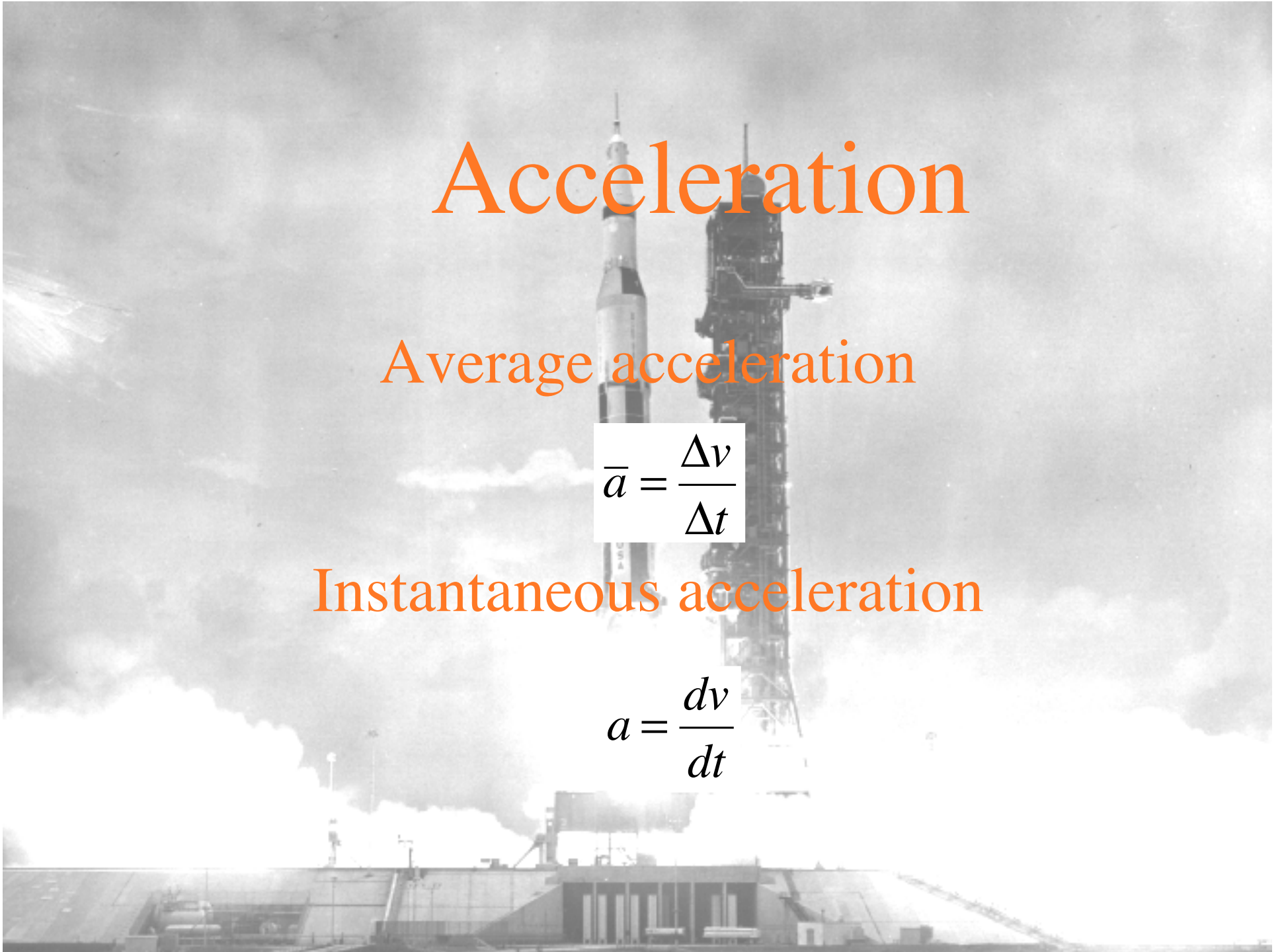
# Acceleration

Average acceleration

$$\bar{a} = \frac{\Delta v}{\Delta t}$$

Instantaneous acceleration

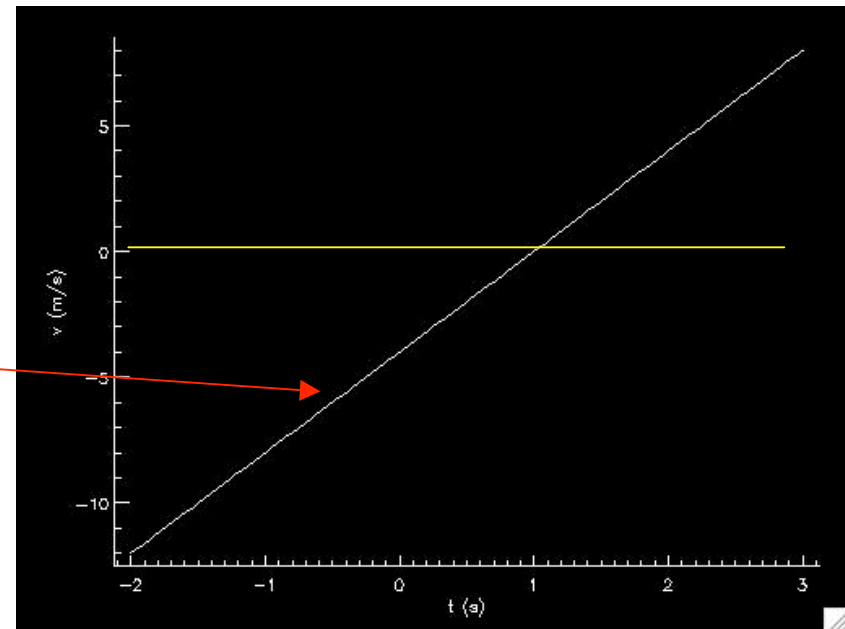
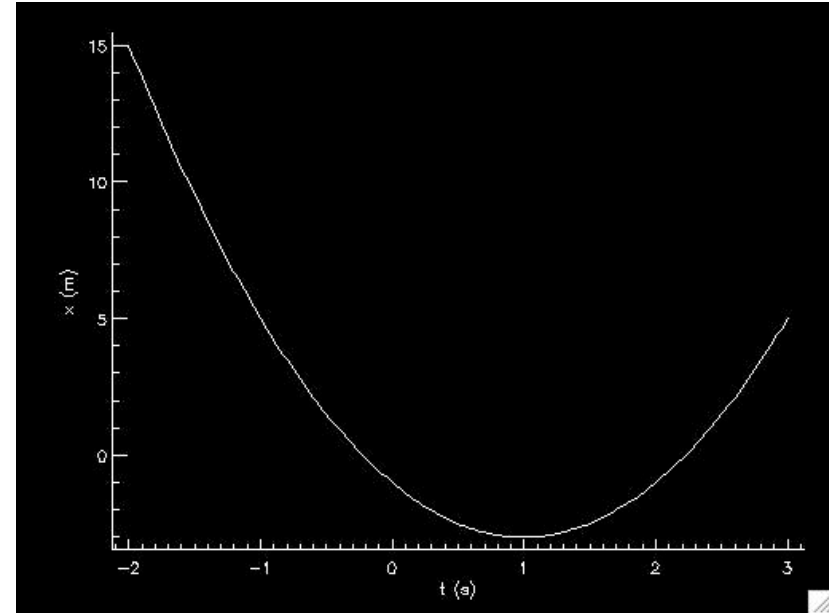
$$a = \frac{dv}{dt}$$

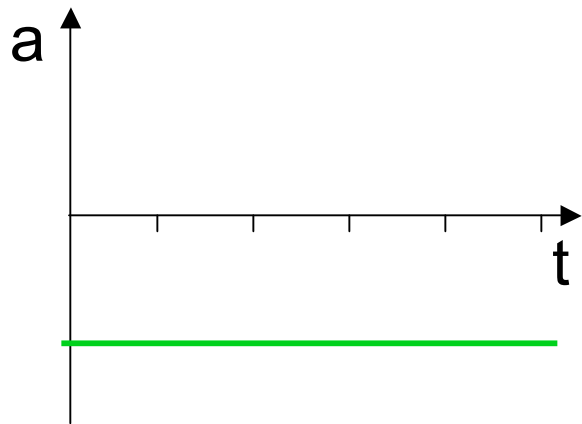
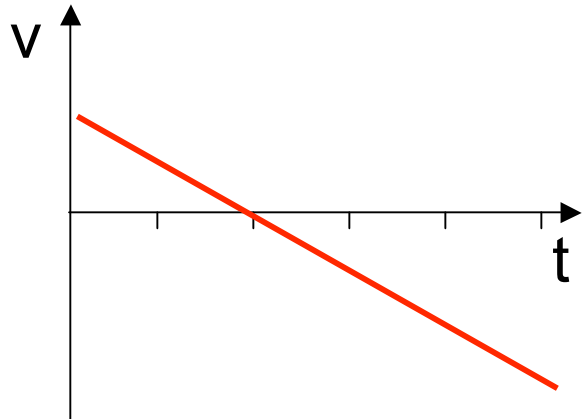
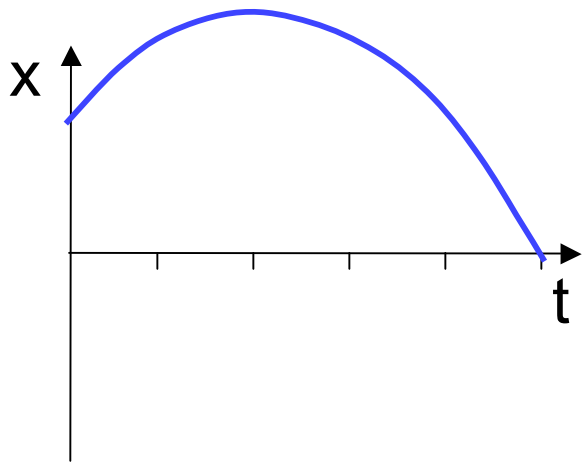


$$v(t) = 2t^2 - 4t - 1$$

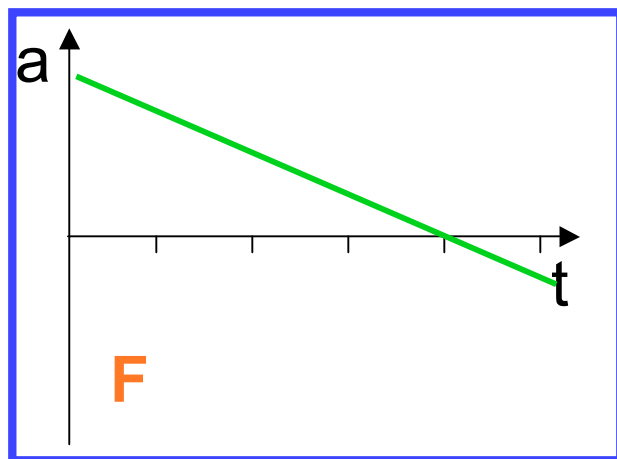
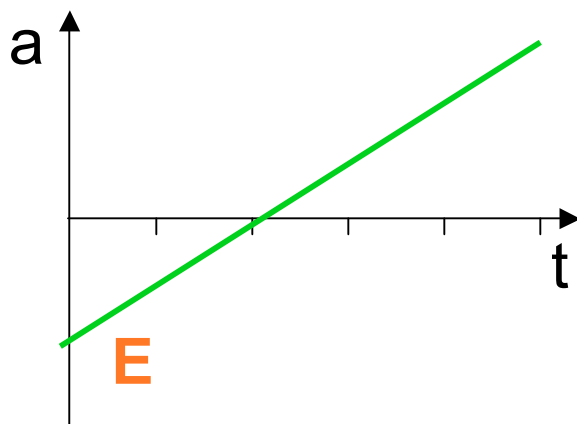
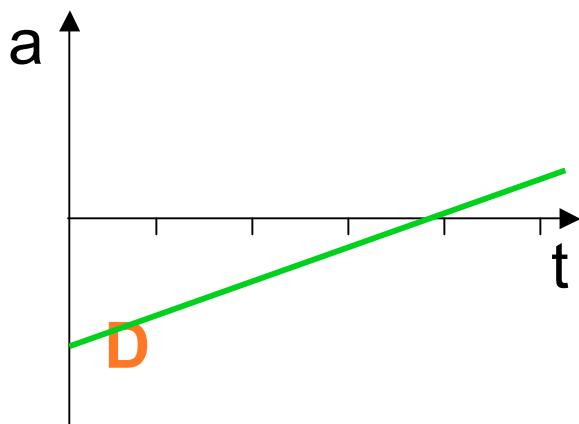
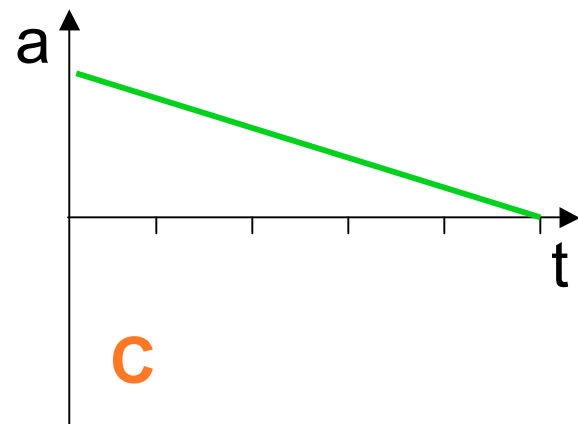
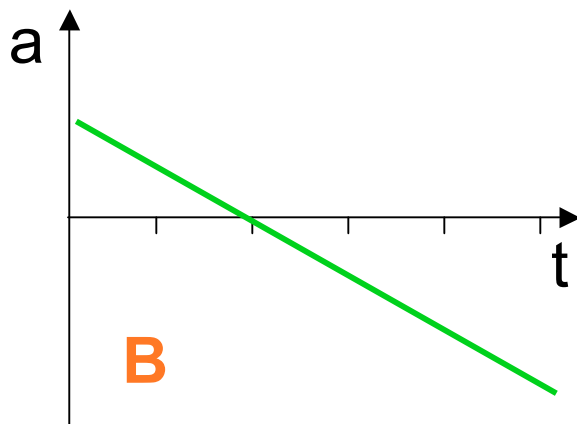
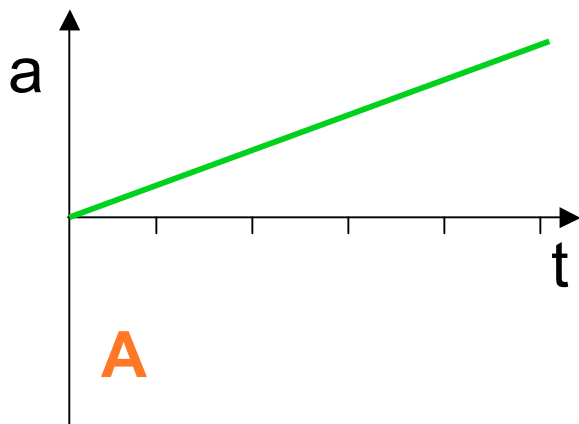
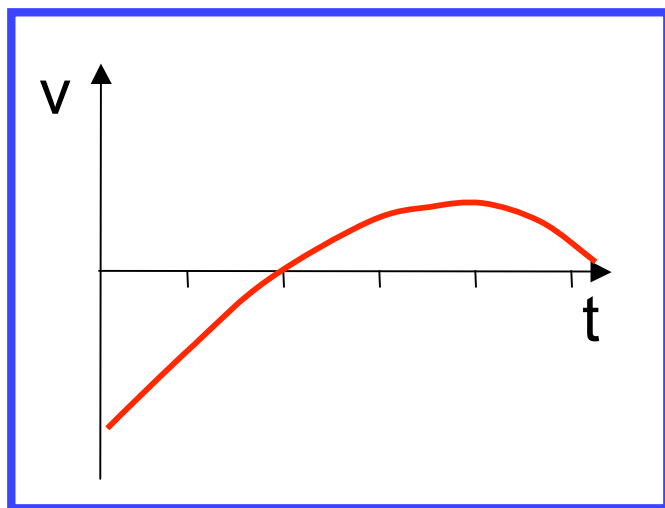
Q: what is  $a(t)$ ?

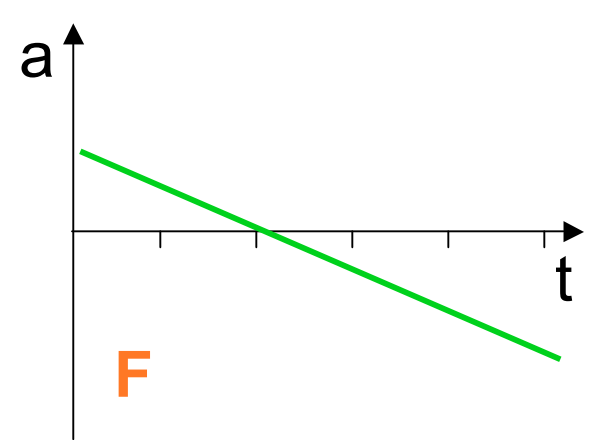
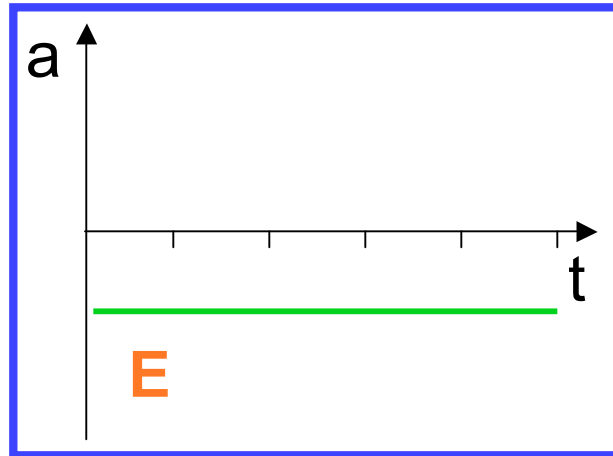
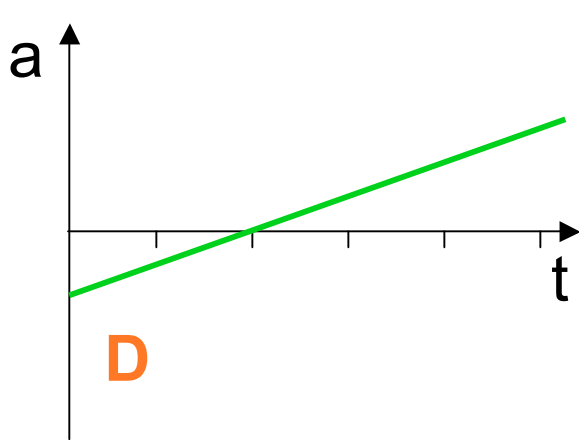
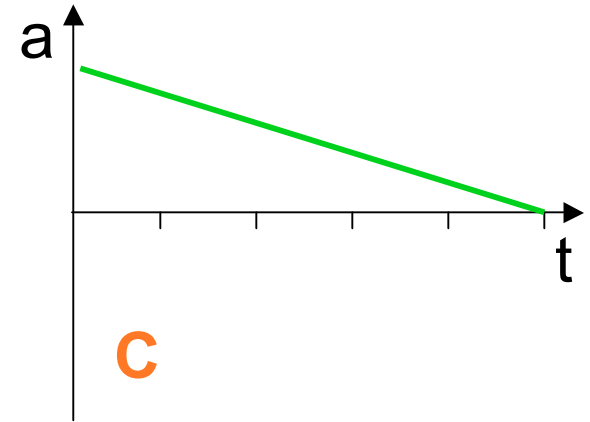
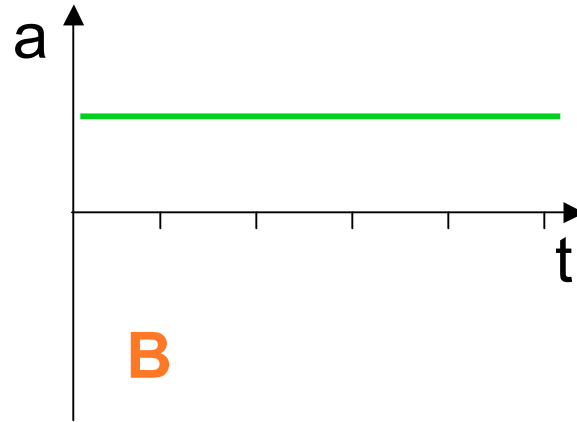
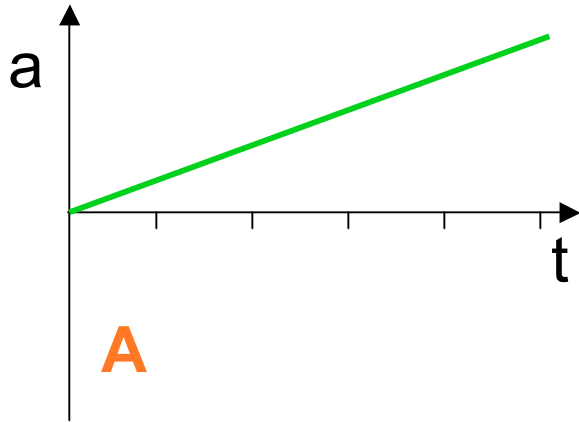
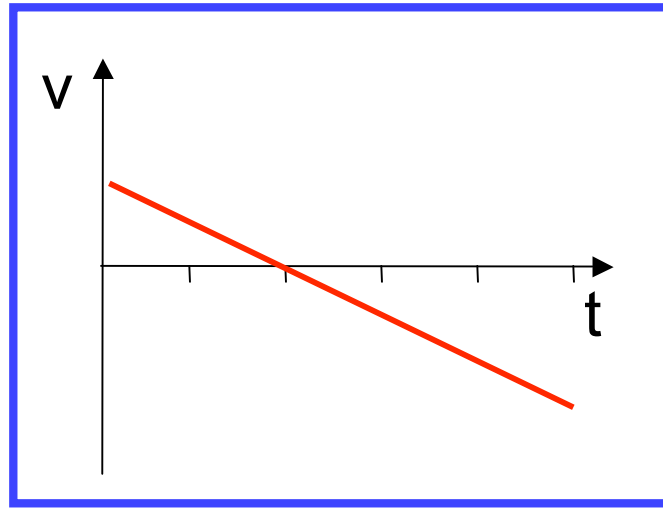
$$a(t) = \frac{dv}{dt} = 4t - 4$$

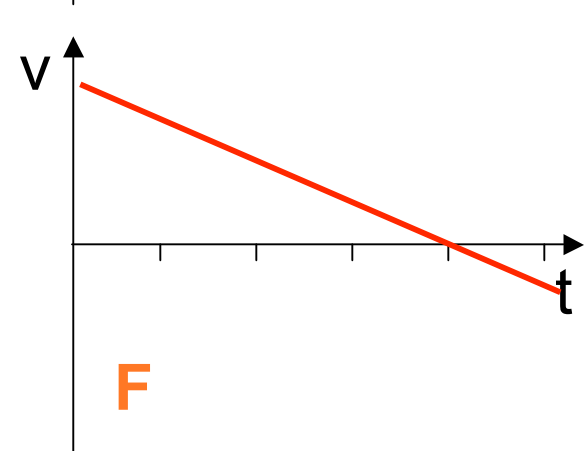
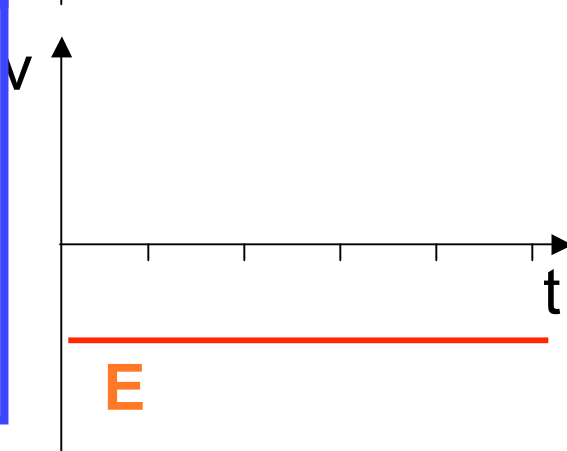
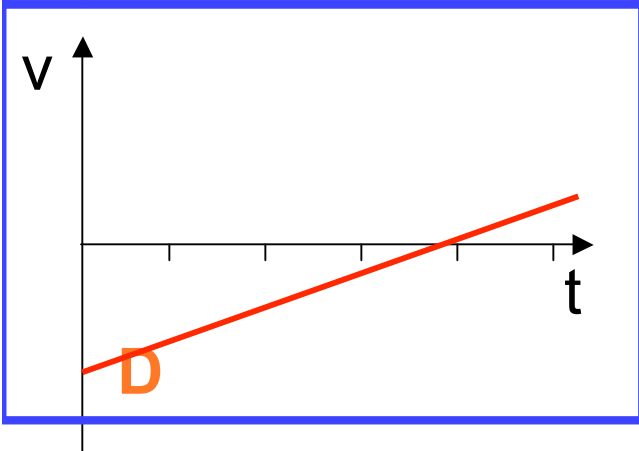
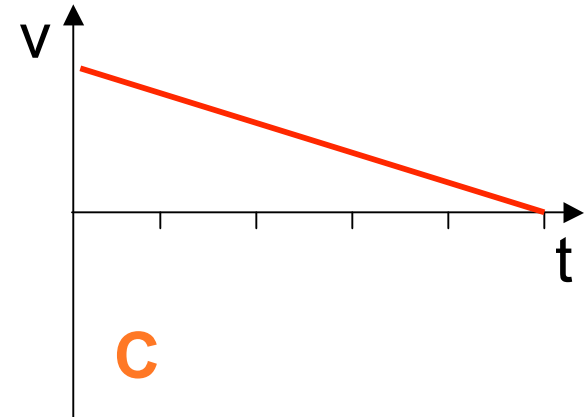
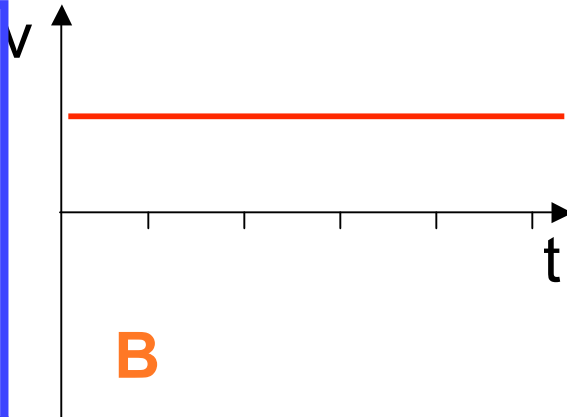
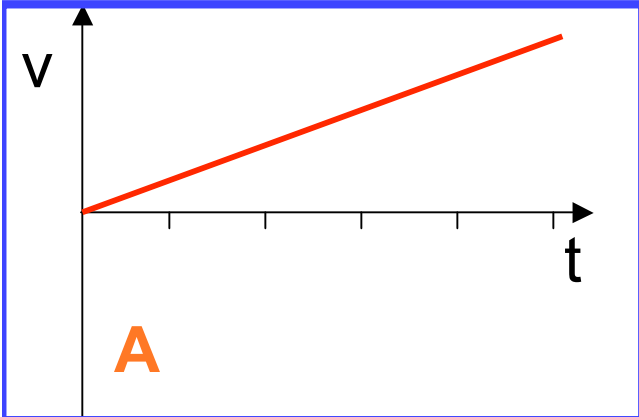
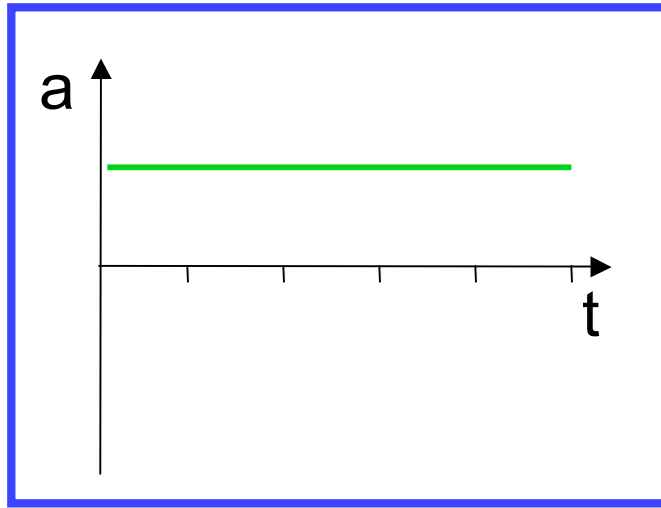




- When is the particle **speeding up**?
- When is the particle **slowing down**?
- In which direction is it accelerating at its extreme position?







## **Physics Activity #2: 1d kinematics**

# Physics Activity #2: 1d kinematics

