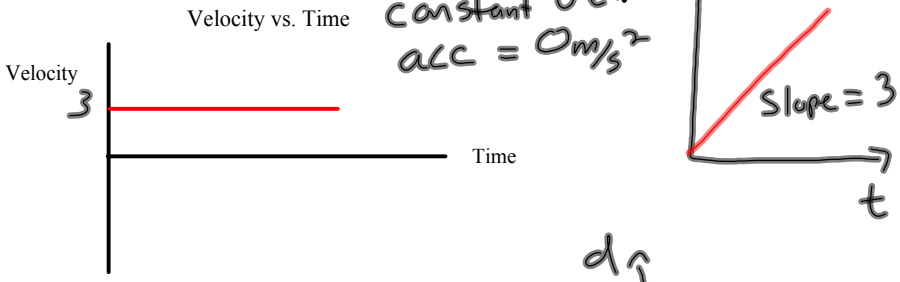
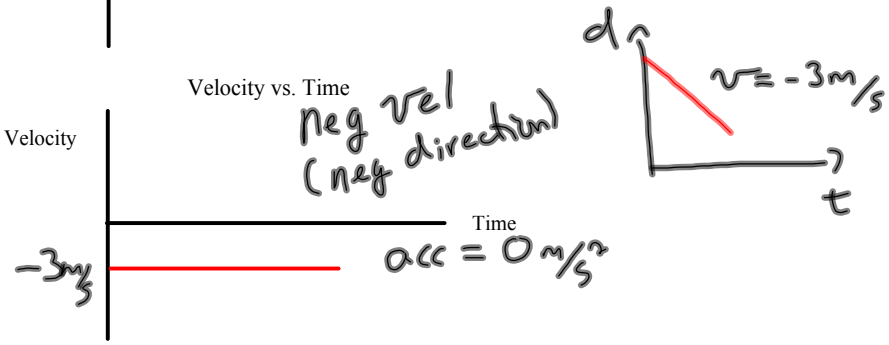
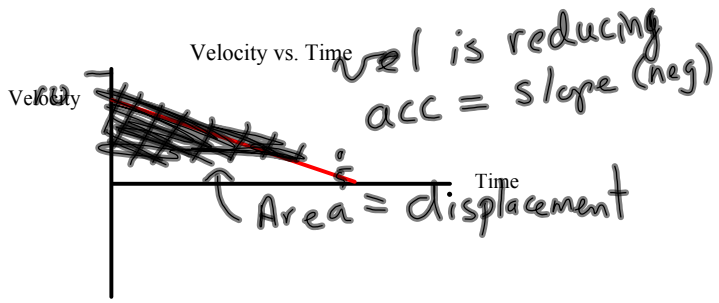
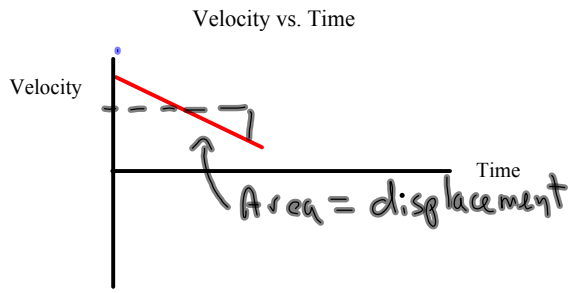
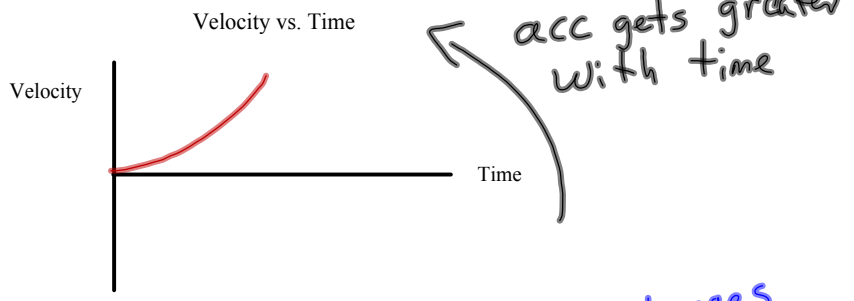
Velocity-Time Graphs

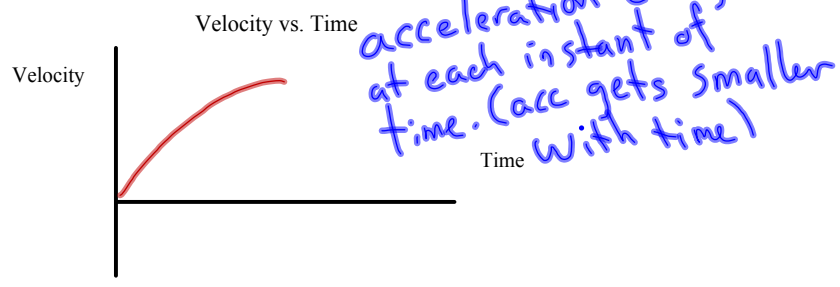






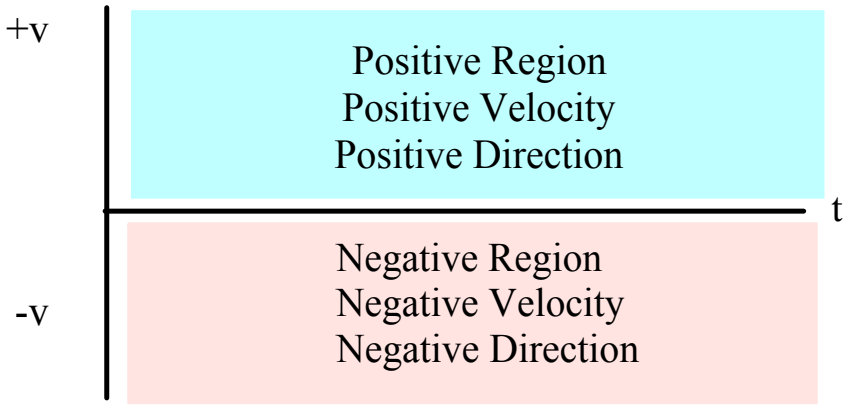




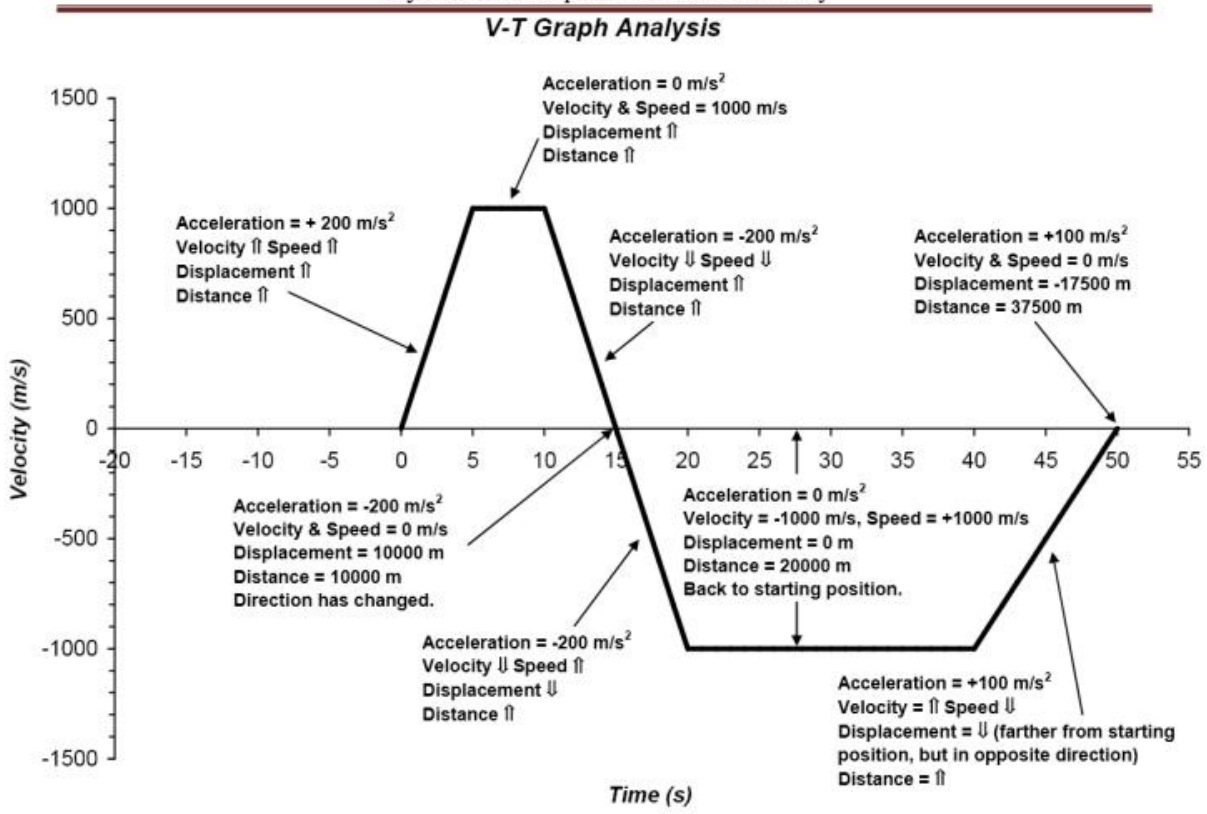


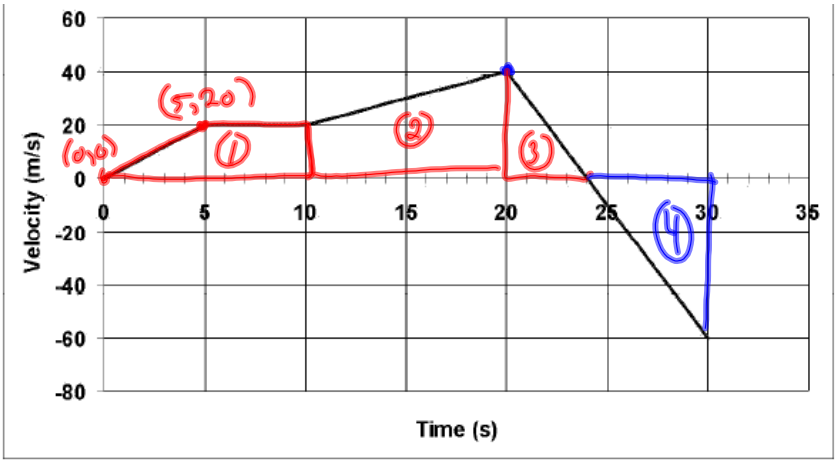
Velocity-Time Graphs

Direction of Motion



If the graph line crosses over the time axis from the positive region to the negative region (or vice versa), then the object has changed directions.


V-T Graph Analysis
Acceleration = 0 m/s²
Velocity & Speed = 1000 m/s
Displacement ⇑
Distance ⇑
Acceleration = + 200 m/s²
Velocity ⇑ Speed ⇑
Displacement ⇑
Distance ⇑
Acceleration = -200 m/s²
Velocity ⇓ Speed ⇓
Displacement ⇑
Distance ⇑
Acceleration = +100 m/s²
Velocity & Speed = 0 m/s
Displacement = -17500 m
Distance = 37500 m
Acceleration = -200 m/s²
Velocity & Speed = 0 m/s
Displacement = 10000 m
Distance = 10000 m
Direction has changed.
Acceleration = 0 m/s²
Velocity = -1000 m/s, Speed = +1000 m/s
Displacement = 0 m
Distance = 20000 m
Back to starting position.
Acceleration = -200 m/s²
Velocity ⇓ Speed ⇑
Displacement ⇓
Distance ⇑
Acceleration = +100 m/s²
Velocity = ⇑ Speed ⇓
Displacement = ⇓ (farther from starting position, but in opposite direction)
Distance = ⇑
Velocity (m/s)
Time (s)
1500
1000
500
0
-500
-1000
-1500
-20
-15
-10
-5
0
5
10
15
20
25
30
35
40
45
50
55



a) $\frac{20-0 \text{ m/s}}{5-0 \text{ s}} = 4 \text{ m/s}^2$ (b) 24 s

Area $= \frac{1}{2} h(b_1 + b_2)$

b_1, b_2 = lengths of parallel lines, h = dist. between || lines.

Areas

$A_1 = \frac{1}{2}(20)(5+10) = 150 \text{ m}$

$A_2 = \frac{1}{2}(10)(20+40) = 300 \text{ m}$

$A_3 = \frac{1}{2}(4)(40) = 80 \text{ m}$

$A_4 = \frac{1}{2}(6)(60) = 180 \text{ m}$

$\text{Disp} = A_1 + A_2 + A_3 - A_4$

$= 150 + 300 + 80 - 180 = \boxed{350 \text{ m}}$

$\text{Dist} = A_1 + A_2 + A_3 + A_4$

$= 150 + 300 + 80 + 180 = \boxed{710 \text{ m}}$

$\text{Speed Avg} = \frac{\text{Distance}}{\text{Time}} = \frac{710 \text{ m}}{30 \text{ s}} = \boxed{23.7 \text{ m/s}}$

$v_{avg} = \frac{\text{Displacement}}{\text{Time}} = \frac{350}{30} = \boxed{11.7 \text{ m/s}}$