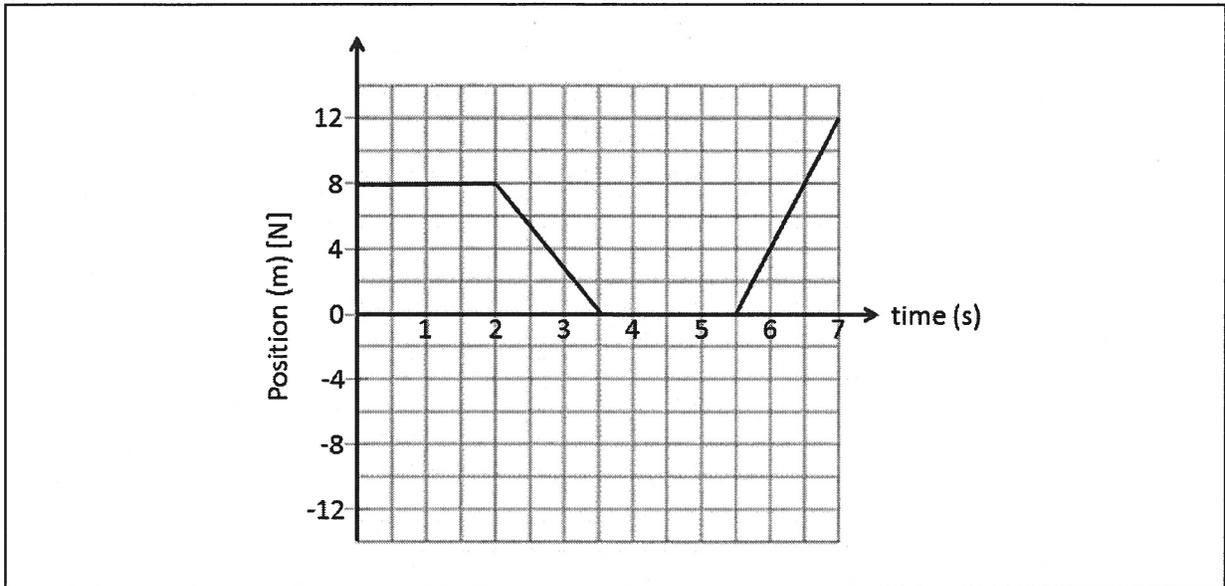


First Name: \_\_\_\_\_

Last Name: \_\_\_\_\_

LO3 - Worksheet - Position-Time Graphs, Velocity-Time Graphs

Use the following information to answer Q1-Q6:



Q1: What is the velocity of the object between 0 and 2 seconds?

No change in position (y-value), so  $\vec{v} = 0 \text{ m/s [N]}$   
 or  $\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{0 \text{ m [N]}}{2 \text{ s}} = \boxed{0 \text{ m/s [N]}}$

Q2: What is the velocity of the object between 2 and 3.5 seconds?

$$\begin{aligned} \Delta \vec{d} &= \vec{d}_f - \vec{d}_i \\ &= 0 \text{ m [N]} - 8 \text{ m [N]} \\ &= -8 \text{ m [N]} \\ &= 8 \text{ m [S]} \end{aligned}$$

$\Rightarrow$  I can also just read this off the y-axis.

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{8 \text{ m [S]}}{1.5 \text{ s}}$$

$$\boxed{\vec{v} = 5.3 \text{ m/s [S]}}$$

Q3: What is the velocity of the object between 5.5 and 7 seconds?

$$\begin{aligned} \Delta \vec{d} &= \vec{d}_f - \vec{d}_i \\ &= 12 \text{ m [N]} - 0 \text{ m [N]} \\ &= 12 \text{ m [N]} \end{aligned}$$

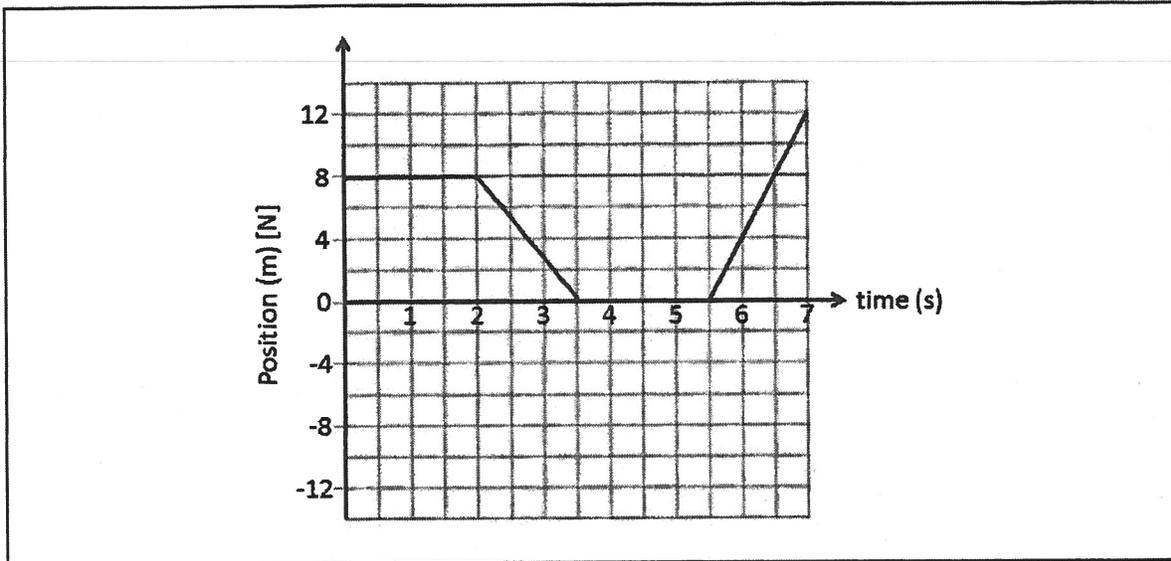
$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{12 \text{ m [N]}}{1.5 \text{ s}}$$

$$\boxed{\vec{v} = 8 \text{ m/s [N]}}$$

HINT: Always ask "Can looking at the y-axis help me answer this?"

## KEY

Use the following information to answer Q1-Q6:



Q4: What is the displacement of the object between 0 and 3.5 seconds?

$$\begin{aligned}
 \Delta \vec{d} &= \vec{d}_f - \vec{d}_i \\
 &= 0\text{m}[\text{N}] - 8\text{m}[\text{N}] \\
 &= -8\text{m}[\text{N}] \\
 &= \boxed{8\text{m}[\text{S}]} \rightarrow \text{or just read off the y-axis.}
 \end{aligned}$$

Q5: What is the object moving north?

When position is becoming more positive/northward.  
 so  $\boxed{5.5 \text{ to } 7 \text{ seconds.}}$

Q6: When is the object north of the origin?

When the position (y-value) is greater than zero.

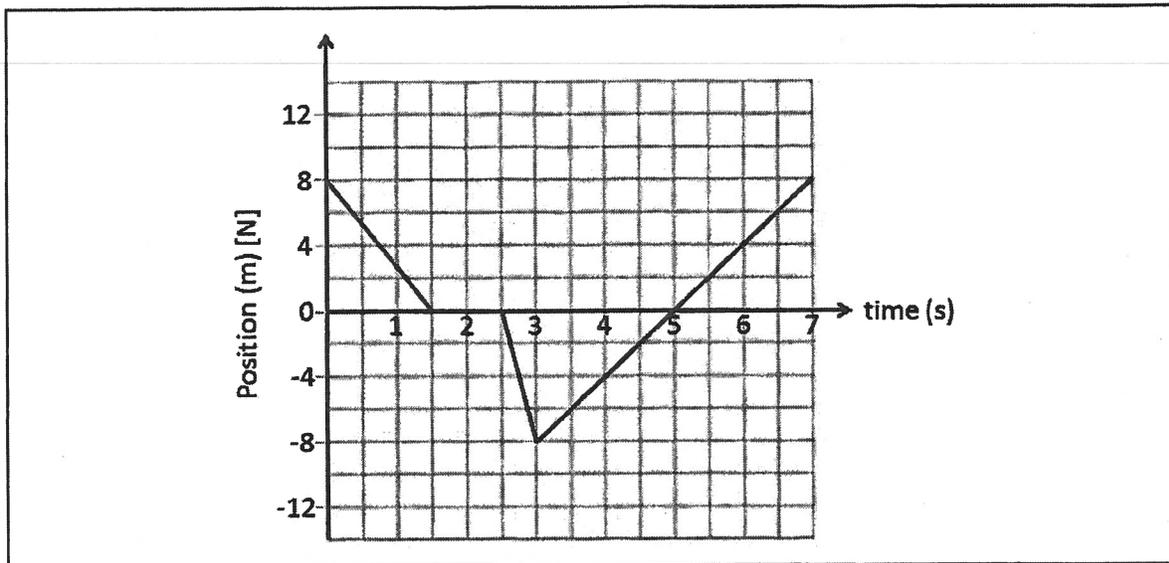
so  $\boxed{0 - 3.5 \text{ seconds and } 5.5 - 7 \text{ seconds.}}$

(From 3.5 to 5.5 seconds it is at the origin, not north of it)

**HINT:** Always ask "Can looking at the y-axis help me answer this?"

KEY

Use the following information to answer Q7-Q12:



Q7: What is the velocity of the object between 0 and 1.5 seconds?

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{\vec{d}_f - \vec{d}_i}{t} = \frac{0\text{m}[\text{N}] - 8\text{m}[\text{N}]}{1.5\text{s}} = \frac{-8\text{m}[\text{N}]}{1.5\text{s}} = -5.3\text{ m/s}[\text{N}]$$

$$\vec{v} = 5.3\text{ m/s}[\text{N}]$$

Q8: What is the velocity of the object between 3 and 5 seconds?

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{\vec{d}_f - \vec{d}_i}{t} = \frac{0\text{m}[\text{N}] - (-8\text{m}[\text{N}])}{2\text{s}} = \frac{8\text{m}[\text{N}]}{2\text{s}} = 4\text{ m/s}[\text{N}]$$

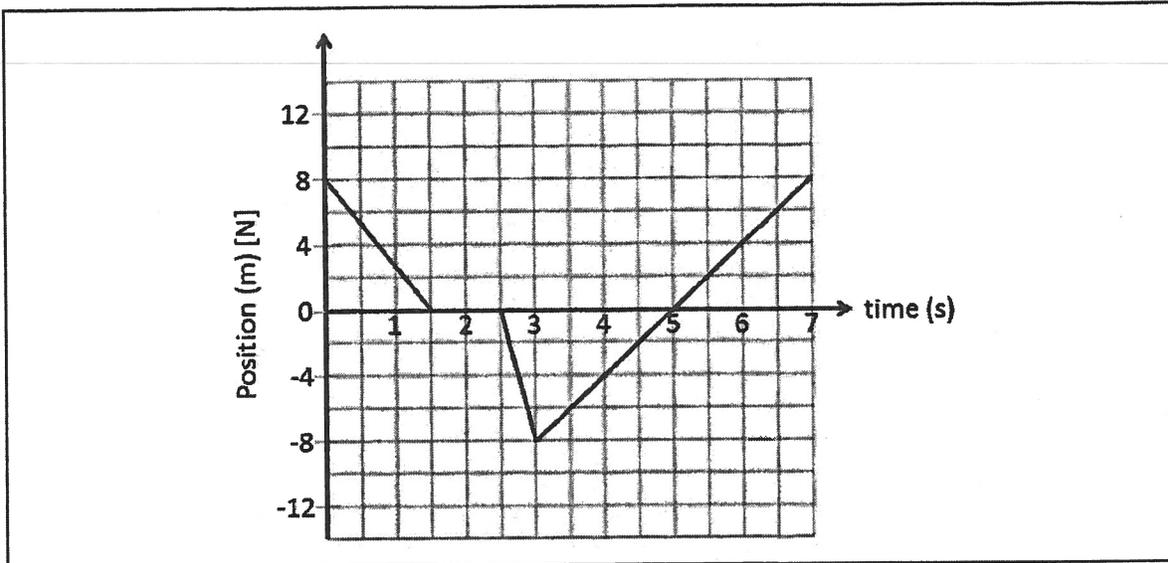
Q9: What is the velocity of the object between 5 and 7 seconds?

Same slope as Q8? Then same velocity.  $\vec{v} = 4\text{ m/s}[\text{N}]$

$$\vec{v} = \frac{\Delta \vec{d}}{\Delta t} = \frac{\vec{d}_f - \vec{d}_i}{t} = \frac{8\text{m}[\text{N}] - 0\text{m}[\text{N}]}{2\text{s}} = \frac{8\text{m}[\text{N}]}{2\text{s}} = 4\text{ m/s}[\text{N}]$$

HINT: Always ask "Can looking at the y-axis help me answer this?"

Use the following information to answer Q7-Q12:



Q10: What is the displacement of the object between 3 and 7 seconds?

$$\begin{aligned} \Delta \vec{d} &= \vec{d}_f - \vec{d}_i \\ &= 8\text{m}[\text{N}] - (-8\text{m}[\text{N}]) \\ &= 16\text{m}[\text{N}] \end{aligned} \leftarrow \text{Could have also just checked the y-axis.}$$

Q11: When is the object moving north?

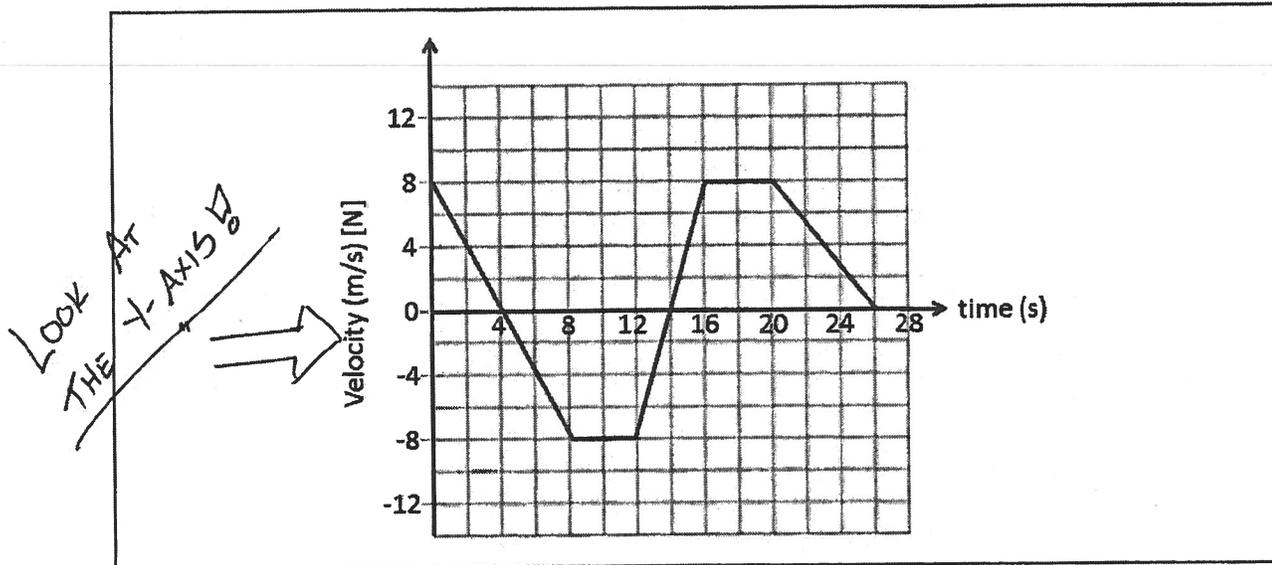
When position is becoming more positive/northward.  
 So 3 to 7 seconds

Q12: When is the object north of the origin?

When position (y-value) is positive.  
 So 0-1.5 seconds, 5-7 seconds

HINT: Always ask "Can looking at the y-axis help me answer this?"

Use the following information to answer Q13-Q18:



Q13: What is the acceleration of the object between 0 and 8 seconds?

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{t} = \frac{-8 \text{ m/s} [\text{N}] - 8 \text{ m/s} [\text{N}]}{8 \text{ s}} = \frac{-16 \text{ m/s} [\text{N}]}{8 \text{ s}} = -2 \text{ m/s}^2 [\text{N}]$$

$$\vec{a} = 2 \text{ m/s}^2 [\text{N}]$$

Q14: What is the velocity of the object at 16 seconds?

Just look at the y-axis.

$$\vec{v} = 8 \text{ m/s} [\text{N}]$$

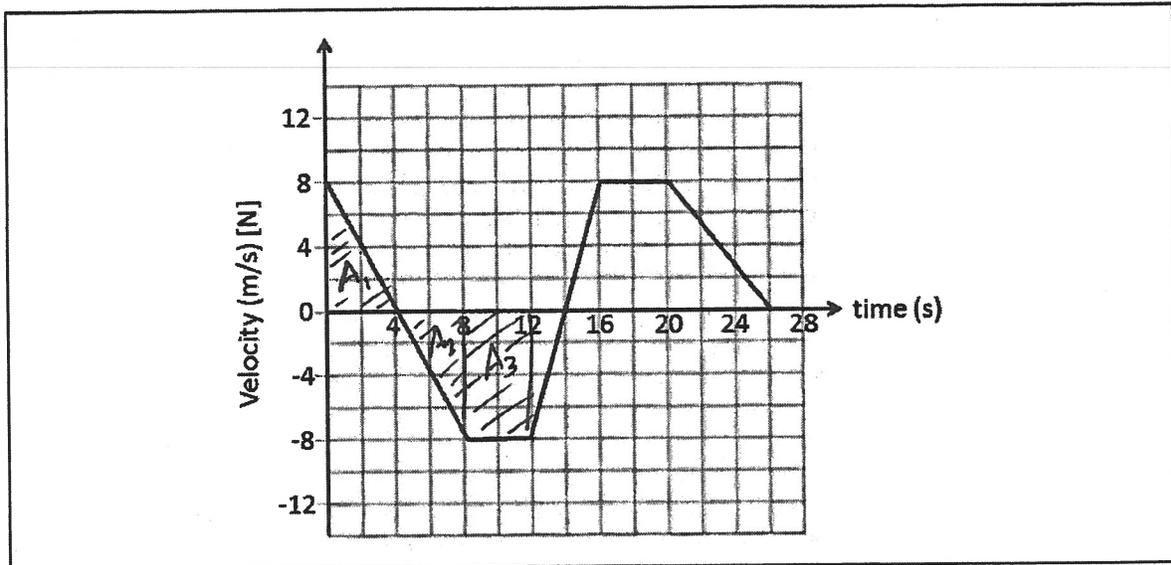
Q15: When is the object moving with constant velocity?

When the y-value (velocity) isn't changing.

So  $8-12$  seconds,  $16-20$  seconds

KEY

Use the following information to answer Q13-Q18:



Q16: When is the object stationary?

When the velocity (y-value) is zero.  
So  $\boxed{26-28 \text{ seconds.}}$

Q17: When is the object decelerating?

When the velocity is becoming closer to zero.  
So  $\boxed{0-4 \text{ seconds, } 12-14 \text{ seconds, } 20-26 \text{ seconds.}}$

Q18: What is the displacement of the object between 0 and 12 seconds?

Displacement is area under graph.

$$A_1 = \frac{1}{2}bh = \frac{1}{2}(4)(8) = 16$$

$$A_2 = \frac{1}{2}bh = \frac{1}{2}(4)(-8) = -16$$

$$A_3 = bh = (4)(-8) = -32$$

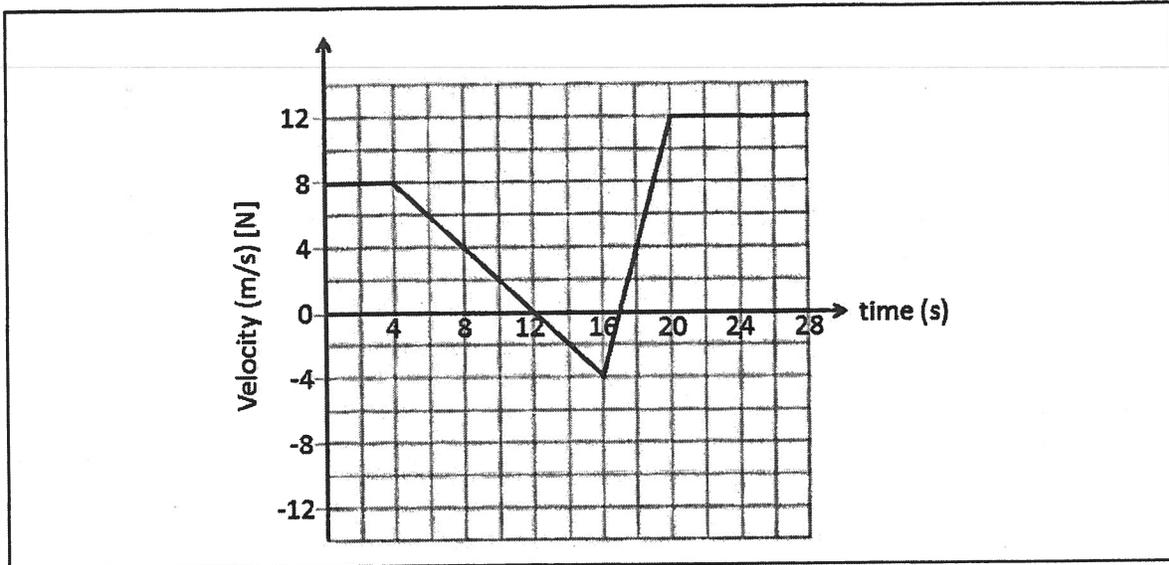
$$\text{TOTAL} = -32, \text{ so } \Delta \vec{d} = -32 \text{ m [W]}$$

$$\boxed{\Delta d = 32 \text{ m [E]}}$$

HINT: Always ask "Can looking at the y-axis help me answer this?"

KEY

Use the following information to answer Q19-Q24:



Q19: What is the acceleration of the object between 4 and 16 seconds?

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_f - \vec{v}_i}{t} = \frac{-4 \text{ m/s} [\text{u}] - 8 \text{ m/s} [\text{u}]}{12 \text{ sec}} = \frac{-12 \text{ m/s} [\text{u}]}{12 \text{ s}}$$

$$\vec{a} = -1 \text{ m/s}^2 [\text{u}]$$

$$\vec{a} = 1 \text{ m/s}^2 [\text{s}]$$

Q20: What is the velocity of the object at 16 seconds?

Read the y-axis (velocity) value.

$$\vec{v} = -4 \text{ m/s} [\text{u}]$$

$$\vec{v} = 4 \text{ m/s} [\text{s}]$$

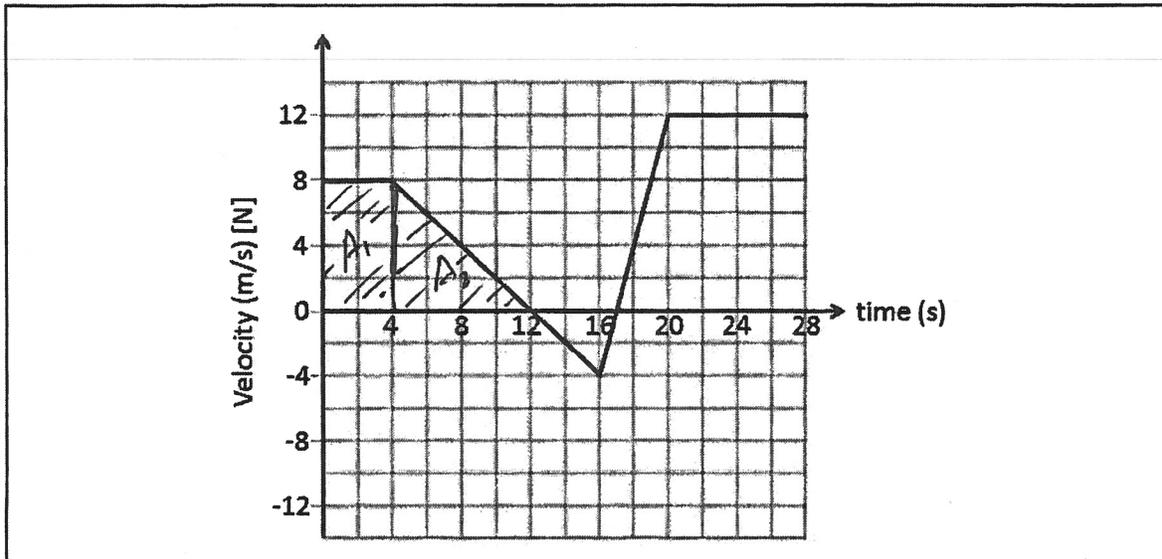
Q21: When is the object moving with constant velocity?

When y-value (velocity) isn't changing.

$$\text{so } [0-4 \text{ sec}, 20-28 \text{ sec.}]$$

HINT: Always ask "Can looking at the y-axis help me answer this?"

Use the following information to answer Q19-Q24:



Q22: When is the object stationary?

When y-value (velocity) is zero for a period of time.  
 so never.

Q23: When is the object decelerating?

When the velocity (y-value) is getting closer to zero.  
 so 4-12 seconds, 16-20 seconds.

Q24: What is the displacement of the object between 0 and 12 seconds?

Displacement is area under the graph.

$$A_1 = bh = (4)(8) = 32$$

$$A_2 = \frac{1}{2}bh = \frac{1}{2}(8)(8) = 32$$

$$\text{TOTAL} = 64$$

$$\Delta s = 64 \text{ m [N]}$$

HINT: Always ask "Can looking at the y-axis help me answer this?"