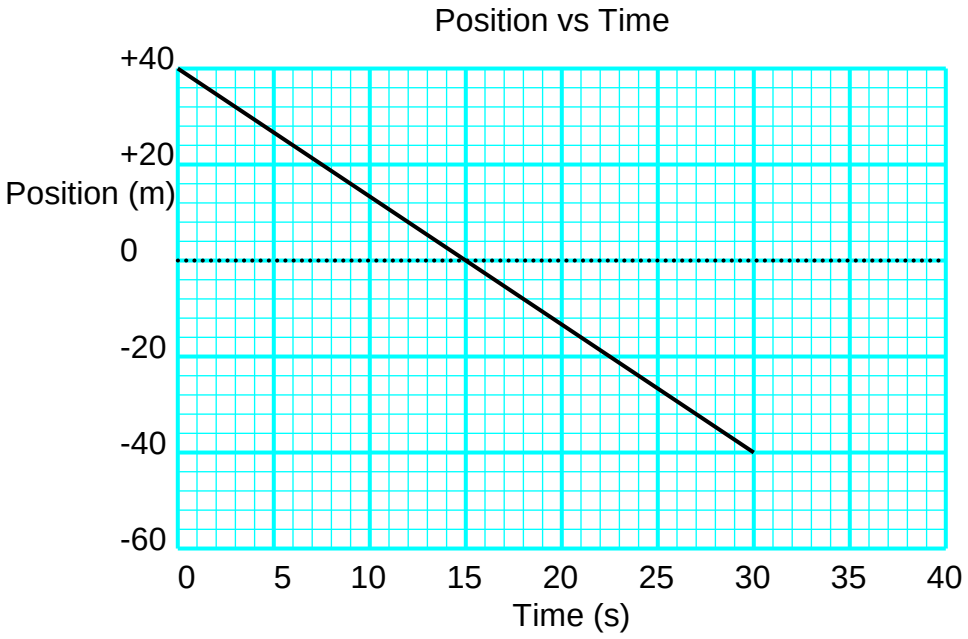
Physics 20 - Lesson 3
Velocity – Graphical Analysis – Answer Key

1. Use the graph below to answer parts A to C.



A. What was the velocity of the object at 5 s and at 25 s? (-2.67 m/s)

V=slope of P-T graph $slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-40m - 40m}{30s - 0s} = \frac{-80m}{30s} = -2.67\,{}^{m}/_{s}$ ✓

B. How much time did the object require to travel 30 m from its starting position? (11.3 s)

$\Delta t = \frac{\Delta d}{V} = \frac{30m}{-2.67\,{}^{m}/_{s}} = 11.3s$ Read off Graph! ✓

C. How far would the object travel in 40 s? (-107 m)

✓

$\Delta d = v \times \Delta t$
$\Delta d = (-2.67\,{}^{m}/_{s})(40s) = -107m$ ✓

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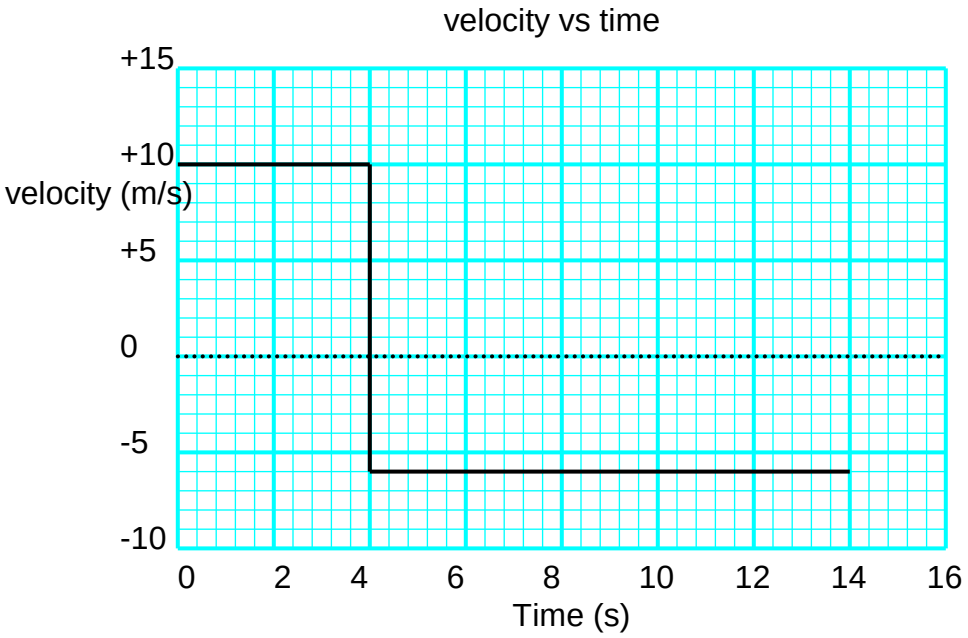
2. Use the graph below to answer parts A and B.



A. What was the object's distance and displacement for the 0 to 8.0 second interval? (64 m, +16 m)

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$d_1 = (10m/s)(4s) = 40m$ ✓
$d_2 = (6m/s)(4s) = 24m$
$\Delta d = 40m + 24m = \boxed{64m}$ ✓

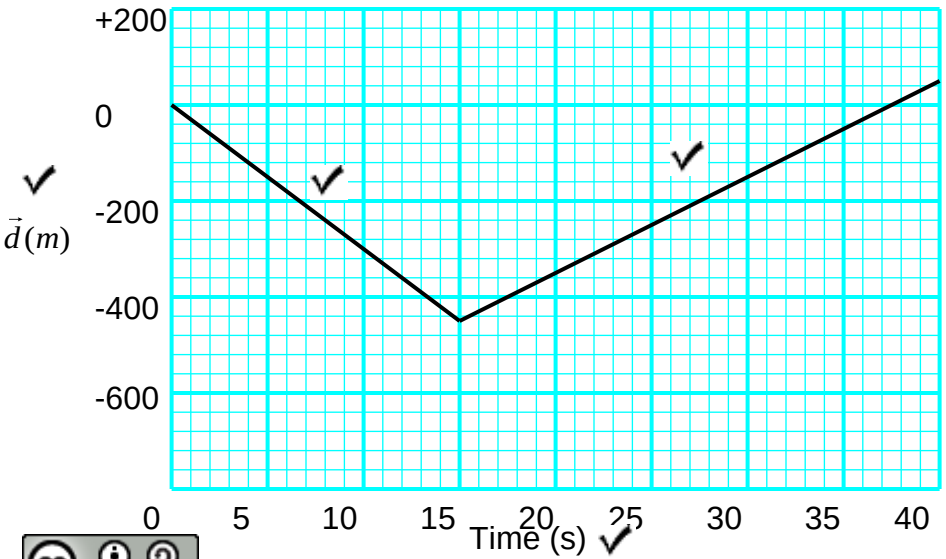
$\Delta\vec{d} = v_1 \times vt_1 + v_2 \times \Delta t_2$
$\Delta\vec{d} = (10\,{}^{m}\!/_{s})(4s) + (-6\,{}^{m}\!/_{s})(4s)$ ✓
$\Delta\vec{d} = +16m$ ✓

B. At what time was the displacement zero? (10.67 s)

$\Delta t = \frac{\Delta\vec{d}}{\vec{V}} = \frac{10\,{}^{m}\!/_{s}(4s)}{-6.0\,{}^{m}\!/_{s}} = 6.67s$ ✓ ✓ $\qquad 6.67s + 4s = 10.67s$ ✓

3. Draw a displacement - time graph which indicates the motion of an object traveling at a constant velocity of -30 m/s for 15 s and then +20 m/s for another 25 s.

Velocity-Time Graph



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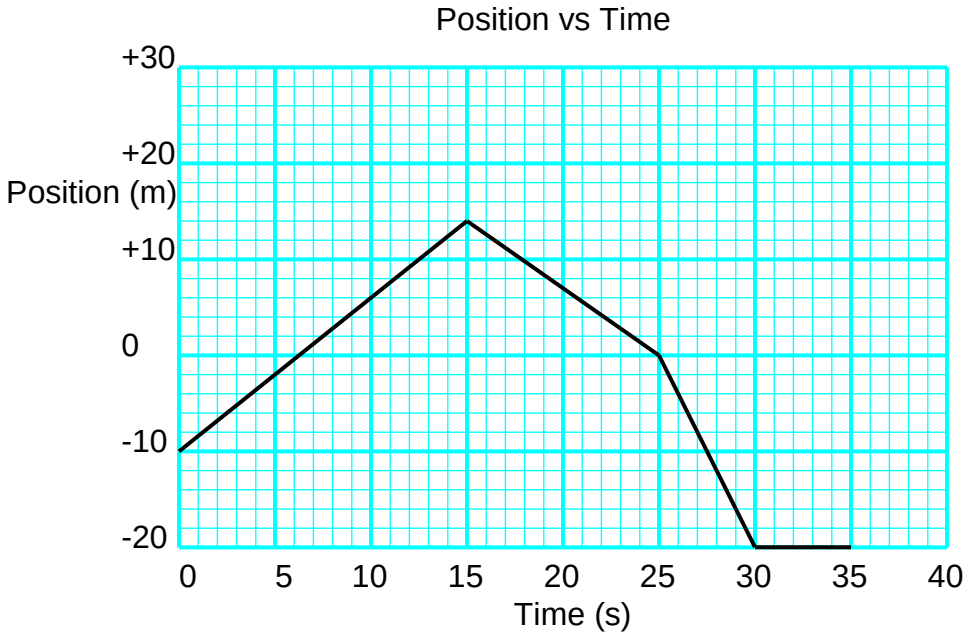
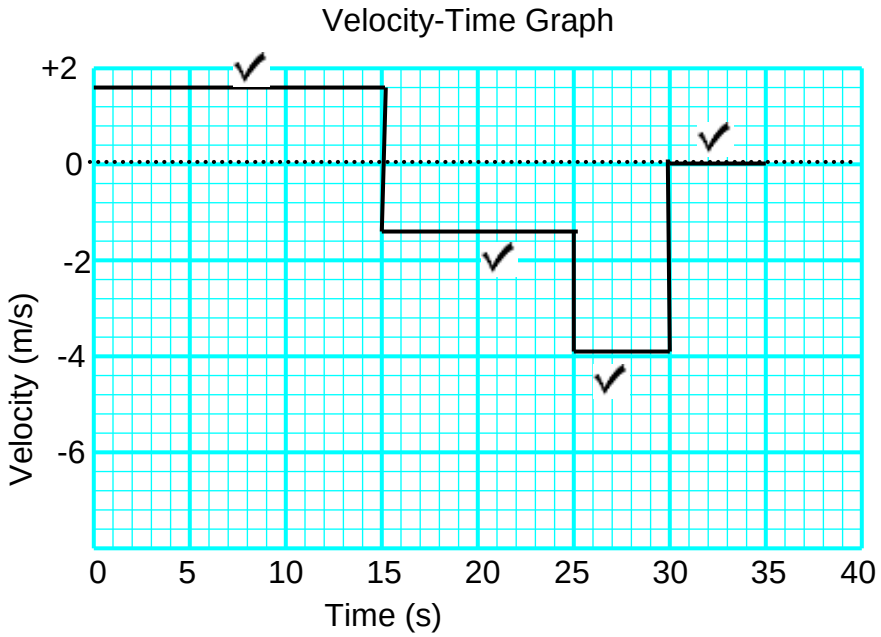
4. From the position – time graph provided, draw an accurate velocity – time graph.





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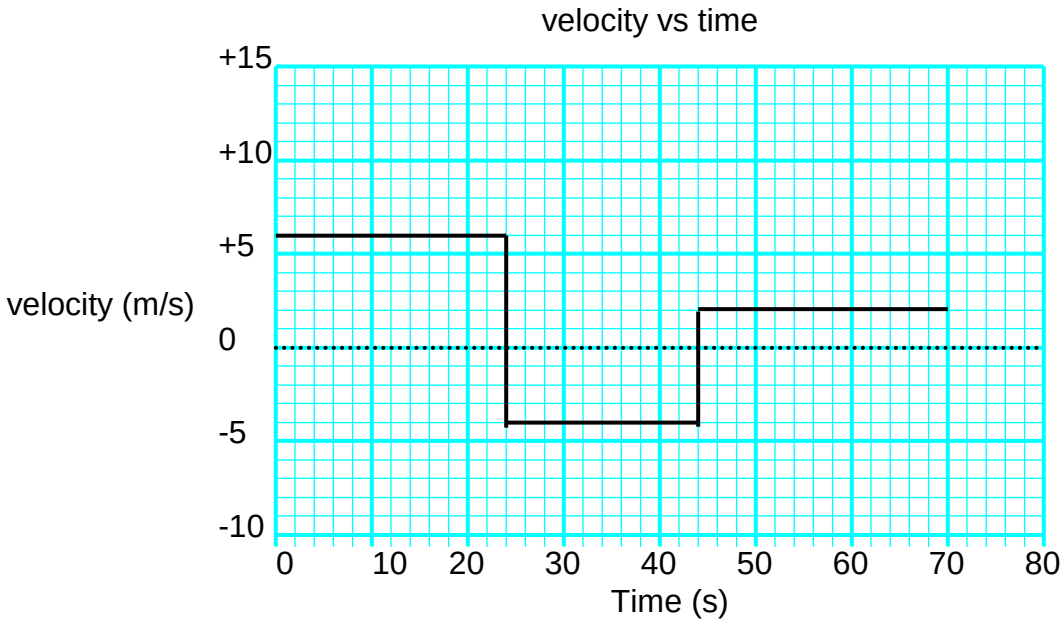
$$slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{14m - (-10m)}{15s - 0s} = \frac{24m}{15s} = +1.6\,{}^{m}/_{s}$$ ✓

$$slope_2 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0m - 14m}{25s - 15s} = \frac{-14m}{10s} = -1.40\,{}^{m}/_{s}$$ ✓

$$slope_3 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-20m - 0m}{30s - 25s} = \frac{-20m}{5s} = -4.0\,{}^{m}/_{s}$$ ✓

$$slope_4 = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-20m - -20m}{35s - 30s} = \frac{0m}{5s} = 0.00\,{}^{m}/_{s}$$ ✓

5. From the velocity – time graph provided, draw an accurate position – time graph.



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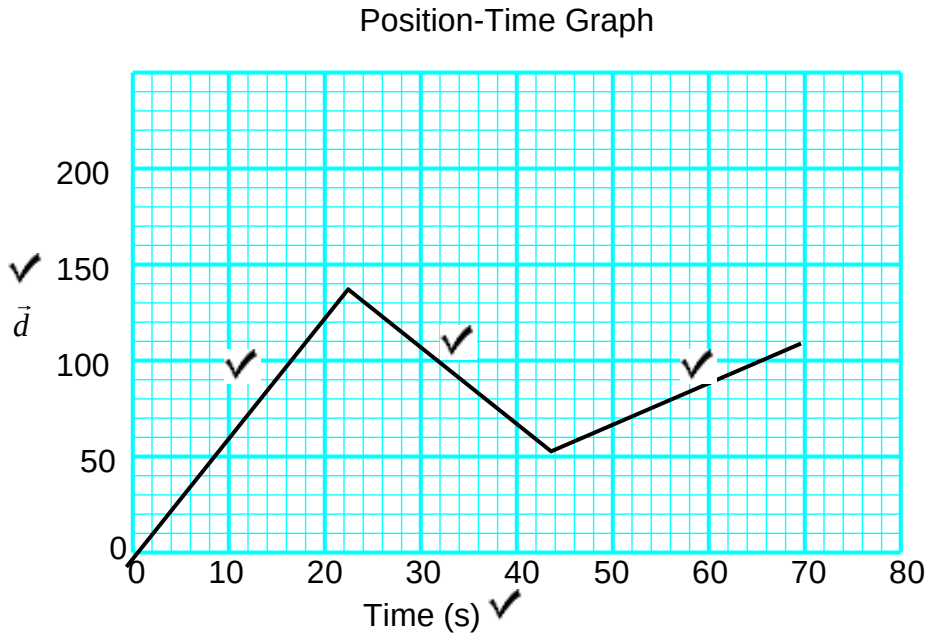


$\vec{d} = \vec{v} \times t$
$\vec{d} = (6m/s)(24s)$
$\vec{d} = 144m$ ✓

$\vec{d} = \vec{v} \times t$
$\vec{d} = (-4m/s)(20s)$
$\vec{d} = -80m$ ✓

$\vec{d} = \vec{v} \times t$
$\vec{d} = (2m/s)(26s)$
$\vec{d} = +52m$ ✓

$\Delta d_1 = 0m + 144$
$\Delta d_1 = +144$ ✓

$\Delta d_2 = +144 + (-80m)$
$\Delta d_2 = +64$ ✓

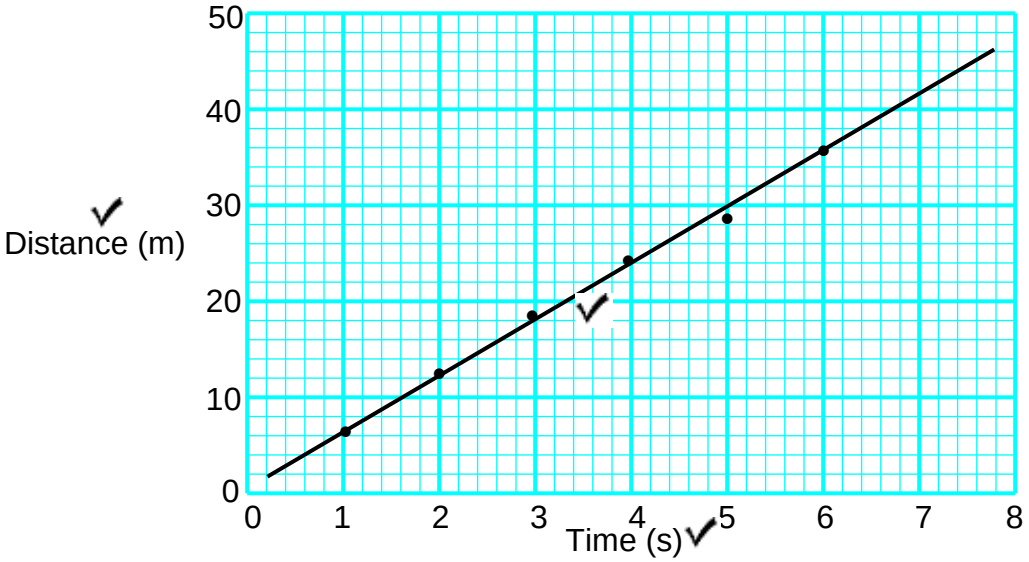
$\Delta d_3 = +64 + (52m)$
$\Delta d_3 = +116m$ ✓

6. Given the following data:

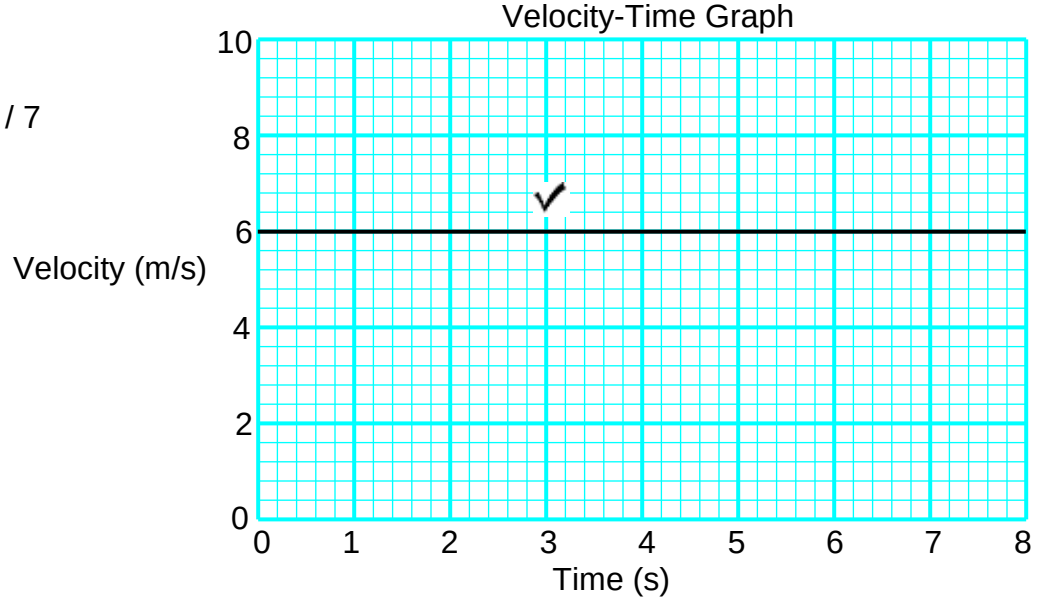
Distance (m)	6	12	18	24	29	36
Time (s)	1	2	3	4	5	6

A. On the graph below, plot a distance time graph.
B. On the other graph, plot the corresponding velocity-time graph. (Show all calculations)

Distance-Time Graph ✓



Velocity-Time Graph



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$$\vec{v} = \frac{\Delta d}{\Delta t} = \frac{36m}{6s} = 6.0\,{}^{m}/_{s}$$ ✓ ✓