Homework Quiz 2B, 18 Sep 2023 MA 131M

1. You are given a displacement graph below. Draw the corresponding velocity graph on the blank grid. Label axes carefully!

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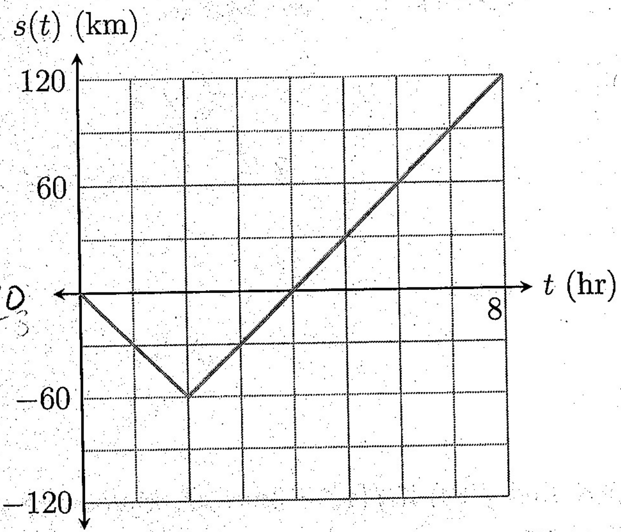
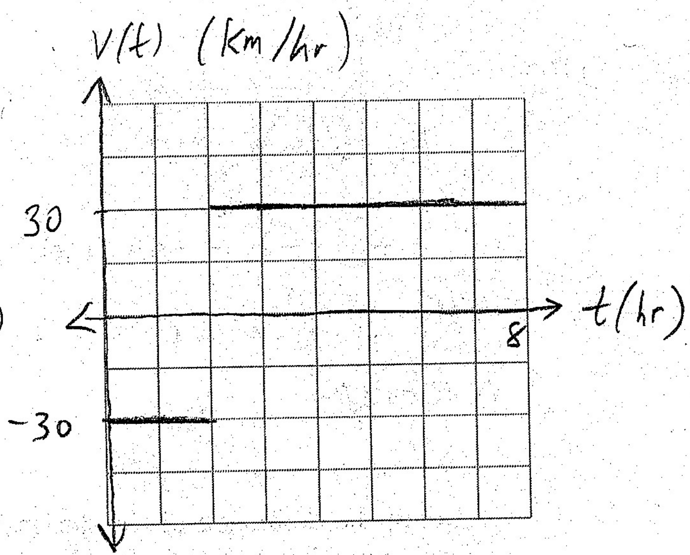
$\frac{-60}{2} = -30$

$\frac{180}{6} = 30$





2. Consider the function $f(x) = \frac{1}{4}x^2 - 2x$, with derivative $f'(x) = \frac{1}{2}x - 2$. Find the equation of the tangent line at $x = 2$. The graph is for reference only, you must use calculus to find the equation of the line. Sketch your line to check your work.

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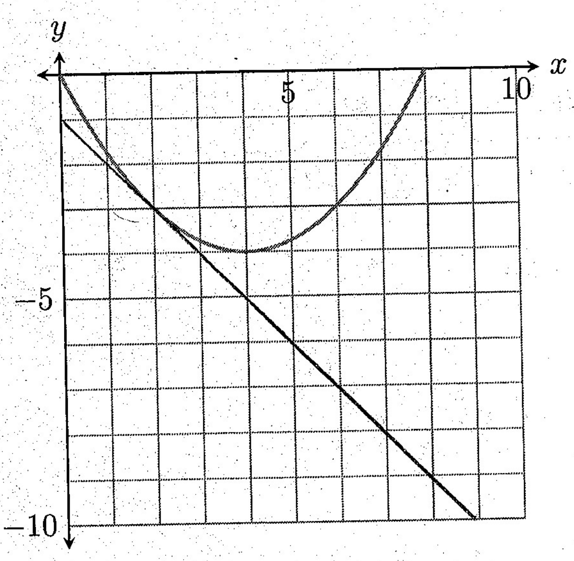

$x = 2$

$m = f'(2) = \frac{1}{2} \cdot 2 - 2 = -1$

$f(2) = \frac{1}{4} \cdot 2^2 - 2 \cdot 2 = -3$

$y - (-3) = -(x - 2)$

$y + 3 = -x + 2$

$y = -x - 1$

3. Below is a graph of a velocity curve. Find an equation for the displacement curve.

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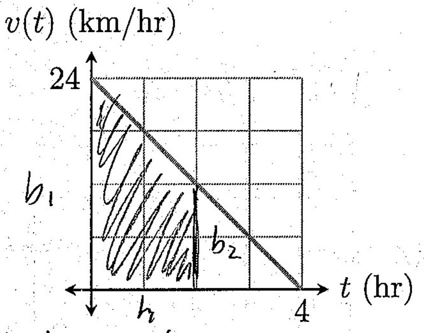

slope: $\frac{-24}{4} = -6$

intercept: 24

$V(t) = -6t + 24$

Trapezoid formula:

$$\begin{aligned} s(t) &= \tfrac{1}{2}(b_1 + b_2)h \\ &= \tfrac{1}{2}(24 + (-6t+24))t \\ &= \tfrac{1}{2}(48 - 6t)t \\ &= 24t - 3t^2 \end{aligned}$$

4. Using the definition of the derivative, find $f'(x)$ if $f(x) = 3x - x^2$. Make sure you use limit notation correctly for the last steps.

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$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\begin{aligned} \frac{f(x+h) - f(x)}{h} &= \frac{3(x+h) - (x+h)^2 - (3x - x^2)}{h} \\ &= \frac{\cancel{3x} + 3h - \cancel{x^2} - 2xh - h^2 - \cancel{3x} + \cancel{x^2}}{h} \\ &= \frac{3h - 2xh - h^2}{h} \\ &= \frac{h(3 - 2x - h)}{h} = 3 - 2x - h \end{aligned}$$

$$f'(x) = \lim_{h \to 0} (3 - 2x - h) = 3 - 2x - 0 = 3 - 2x$$