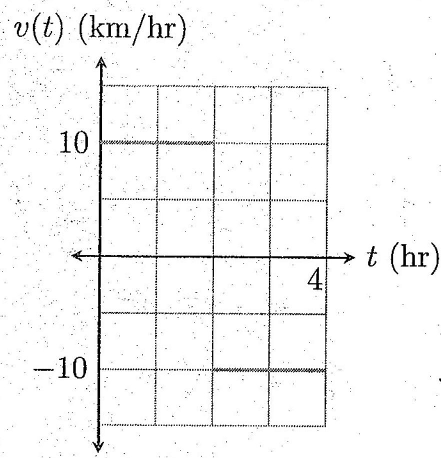
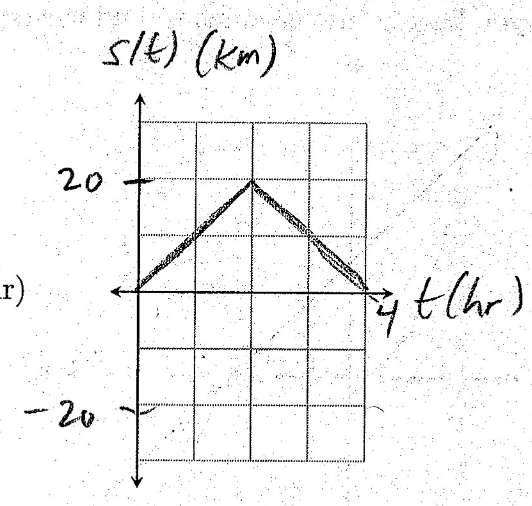
+10

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





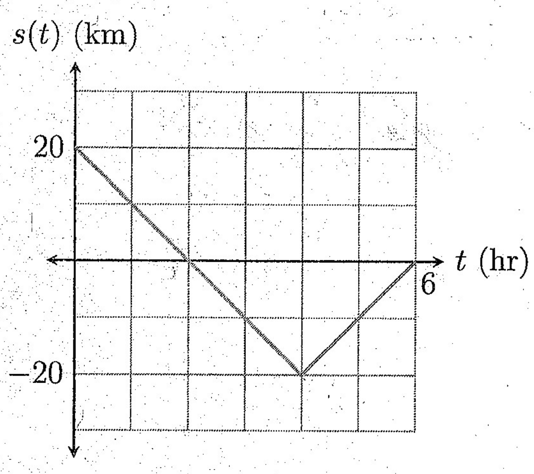
Write a brief sentence describing this journey.

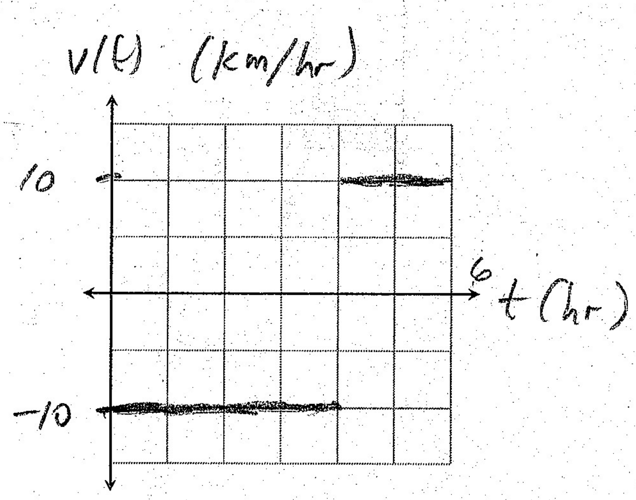
You drive east at 10 km/hr for 2 hours, then west at 10 km/hr for 2 hours.

+10

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

$\text{slope} = \frac{-40}{4} = -10$



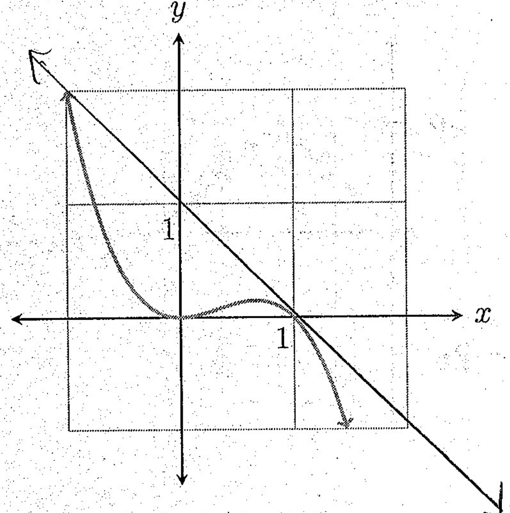


Write a brief sentence describing this journey.

You drive west at 10 km/hr for 4 hours, then east at 10 km/hr for 2 hours.

+10

3. Below is a graph of the function $f(x) = x^2 - x^3$. Find an equation of the tangent line in the form $y = mx + b$ at $x = 1$. You can use the graph to verify your answer, but you have to use calculus to find the equation. Use the fact that $f'(x) = 2x - 3x^2$.



$f(1) = 1^2 - 1^3 = 0$ pt: $(1,0)$

$f'(1) = 2\cdot 1 - 3\cdot 1^2 = -1 =$ slope

$y = -x + b$

$0 = -1 + b \Rightarrow b = 1$

$y = -x + 1$

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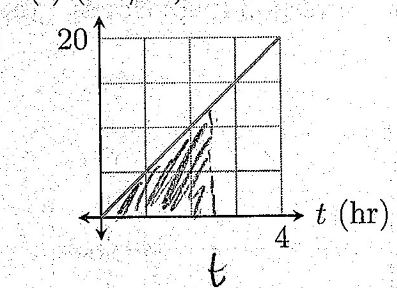
4. Below is a graph of a velocity curve. Find an equation for the displacement curve.



$v(t) = 5t$

Triangle formula

$s(t) = \frac{1}{2}\cdot b \cdot h = \frac{1}{2}\cdot t \cdot 5t = \frac{5}{2}t^2$

5. Find the derivatives of the following functions.

+8

(a) $h(x) = \frac{7}{x^2} = 7x^{-2}$

$h'(x) = -14x^{-3} = \frac{-14}{x^3}$

+8 (b) $h(x) = 3x\cos(x)$ Product Rule

$f(x) = 3x$ $f'(x) = 3$

$g(x) = \cos(x)$ $g'(x) = -\sin(x)$

$$h'(x) = f(x)g'(x) + g(x)f'(x)$$
$$= 3x(-\sin(x)) + \cos(x)\cdot 3$$
$$= -3x\sin(x) + 3\cos(x)$$

+8 (c) $h(x) = \dfrac{2x}{\sin(x)}$ Quotient Rule

$f(x) = 2x$ $f'(x) = 2$

$g(x) = \sin(x)$ $g'(x) = \cos(x)$

$$h'(x) = \frac{g(x)f'(x) - f(x)g'(x)}{g(x)^2} = \frac{\sin(x)\cdot 2 - 2x\cdot\cos(x)}{(\sin(x))^2}$$
$$= \frac{2\sin(x) - 2x\cos(x)}{\sin^2(x)}$$

+8 (d) $h(x) = \cos(5x^2)$ Chain Rule

$f(x) = \cos(x)$ $f'(x) = -\sin(x)$

$g(x) = 5x^2$ $g'(x) = 10x$

$$h'(x) = f'(g(x))\,g'(x) = -\sin(g(x))\cdot 10x$$
$$= -10x\sin(5x^2)$$

6. Suppose $f(x) = \cos(x) - \sqrt{x} - 3$ Find $f'(x)$.

+10

$$= \cos(x) - x^{\frac{1}{2}} - 3$$

$$f'(x) = -\sin(x) - \frac{1}{2}x^{-\frac{1}{2}} = -\sin(x) - \frac{1}{2\sqrt{x}}$$

7. Using the definition of the derivative, find $f'(x)$ if $f(x) = 4 - x^2$.

+12

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

$$\frac{f(x+h) - f(x)}{h} = \frac{4 - (x+h)^2 - (4 - x^2)}{h}$$

$$= \frac{\cancel{4} - (x^2 + 2xh + h^2) - \cancel{4} + x^2}{h}$$

$$= \frac{-x^2 - 2xh - h^2 + x^2}{h}$$

$$= \frac{-2xh - h^2}{h} = \frac{h(-2x - h)}{h} = -2x - h$$

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

8. Fill in the blank with the best answer. Write out words completely; do not use abbreviations.

+6

(a) If $f'(x) < 0$, then the function is decreasing at the point x.

(b) If $f'(x) > 0$, then the function is increasing at the point x.

(c) $f'(x)$ is the slope of the tangent line at the point x.