

An airplane begins its take-off run at A with zero velocity and a constant acceleration a . Knowing that it becomes airborne 30 s later at B with a take-off velocity of 270 km/h, determine (a) the acceleration a , (b) distance AB .

$$270 \frac{\cancel{\text{km}}}{\cancel{\text{h}}} \left(\frac{1000 \text{ m}}{1 \cancel{\text{km}}} \right) \left(\frac{1 \cancel{\text{h}}}{60 \cancel{\text{min}}} \right) \left(\frac{1 \cancel{\text{min}}}{60 \text{ s}} \right) = 75 \text{ m/s}$$



$$V = V_0 + at$$

$$75 \frac{\text{m}}{\text{s}} = 0 \frac{\text{m}}{\text{s}} + a \cdot 30 \text{s}$$

$$75 \frac{\text{m}}{\text{s}} = a \cdot 30 \text{s}$$

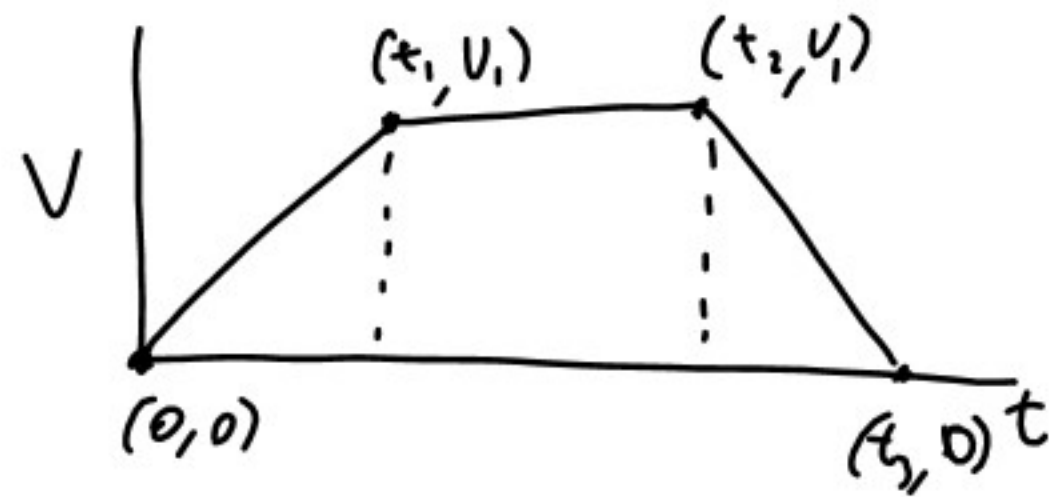
$$\frac{75 \frac{\text{m}}{\text{s}}}{30 \text{s}} = \boxed{2.5 \frac{\text{m}}{\text{s}^2} = a}$$

$$X = X_0 + V_0 t + \frac{1}{2} at^2$$

$$= 0 + 0 \frac{\text{m}}{\text{s}} \cdot 30 \text{s} + \frac{1}{2} \cdot 2.5 \frac{\text{m}}{\text{s}^2} (30 \text{s})^2$$

$$= 1125 \frac{\text{m} \cdot \text{s}^2}{\text{s}^2} = \boxed{1125 \text{m} = 1.125 \text{km}}$$

Graphical Methods



if $x = x_0$ at $t = 0$

$$\text{at } t = t_1 \quad x = x_0 + \frac{t_1 v_1}{2}$$

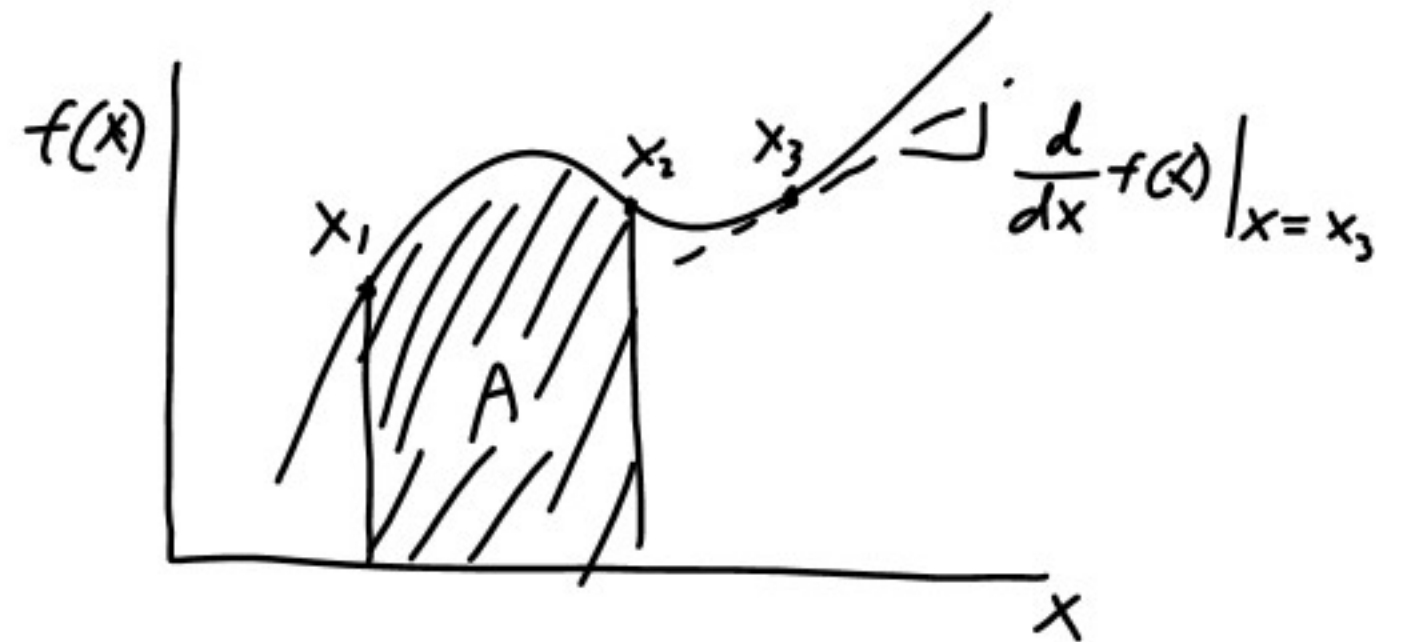
$$\text{at } t = t_2 \quad x = x_0 + \frac{t_1 v_1}{2} + v_1 (t_2 - t_1)$$

from $t = 0$ to $t = t_1$

$$a = \frac{v_1}{t_1}$$

from t_1 to t_2

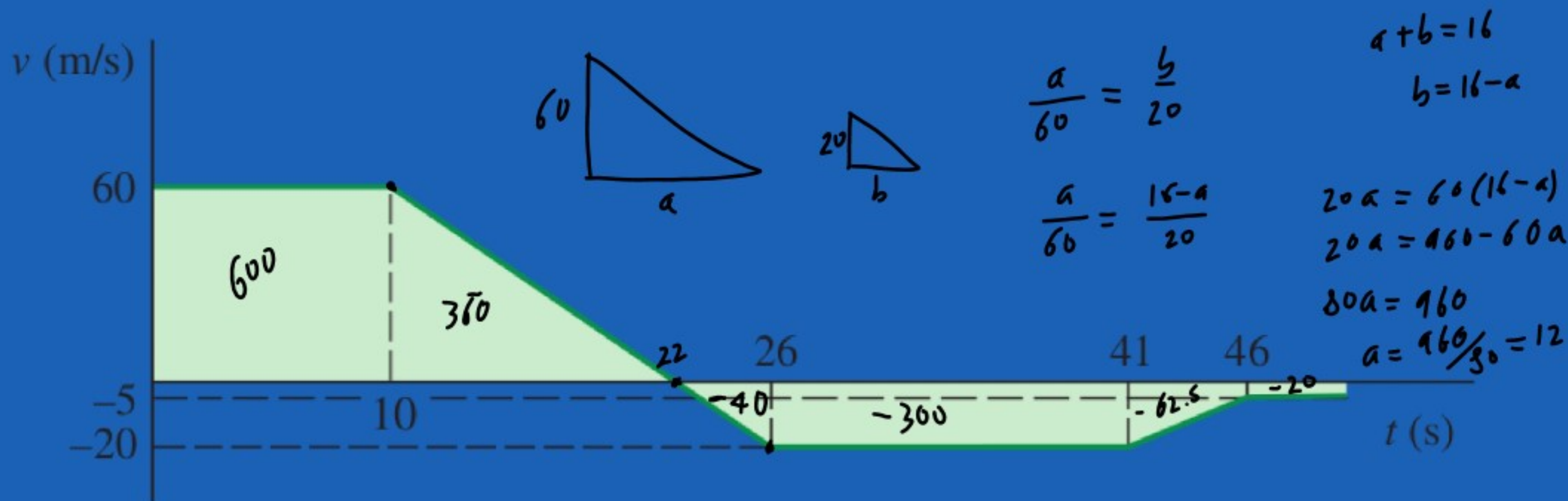
$$a = 0$$

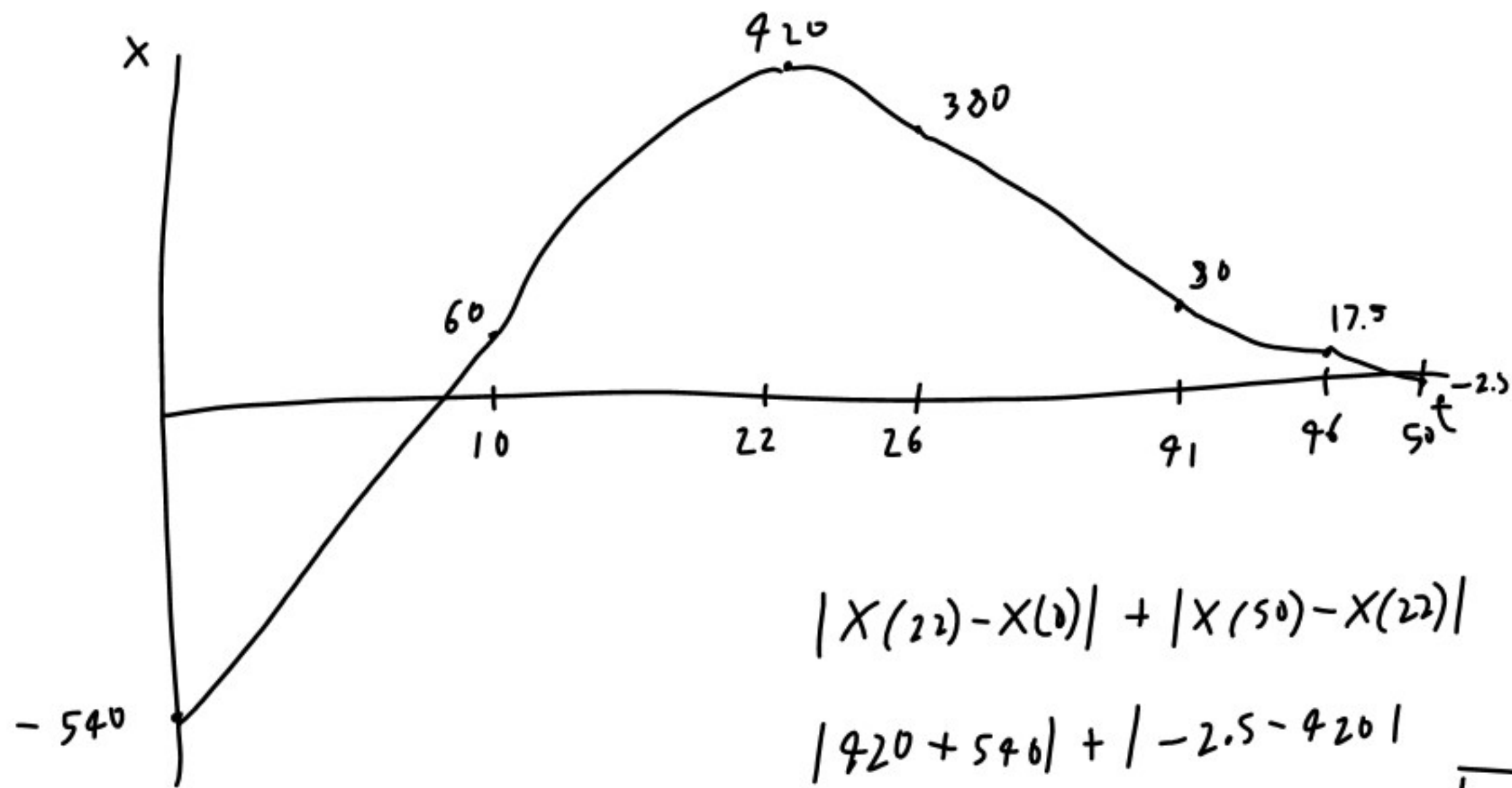


$$A = \int_{x_1}^{x_2} f(x) dx$$

if we have	area under curve	slope
plot of x	n/a	v
plot of v	Δx	a
plot of a	Δv	n/a

A particle moves in a straight line with the velocity shown in the figure. Knowing that $x = -540$ m at $t = 0$, (a) construct the $a-t$ and $x-t$ curves for $0 < t < 50$ s, and determine (b) the total distance traveled by the particle when $t = 50$ s, (c) the two times at which $x = 0$.





$$|X(22) - X(0)| + |X(50) - X(22)|$$

$$|420 + 540| + |-2.5 - 420|$$

$$960 + |-422.5| = 960 + 422.5 = \boxed{1382.5 \text{ m}}$$

