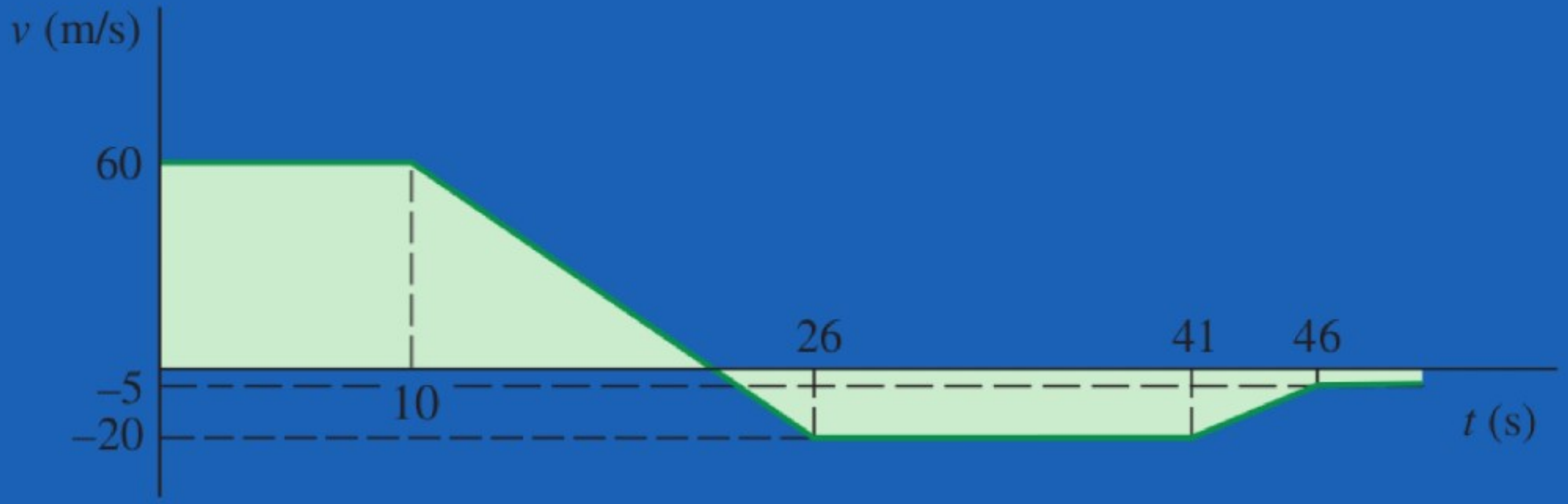
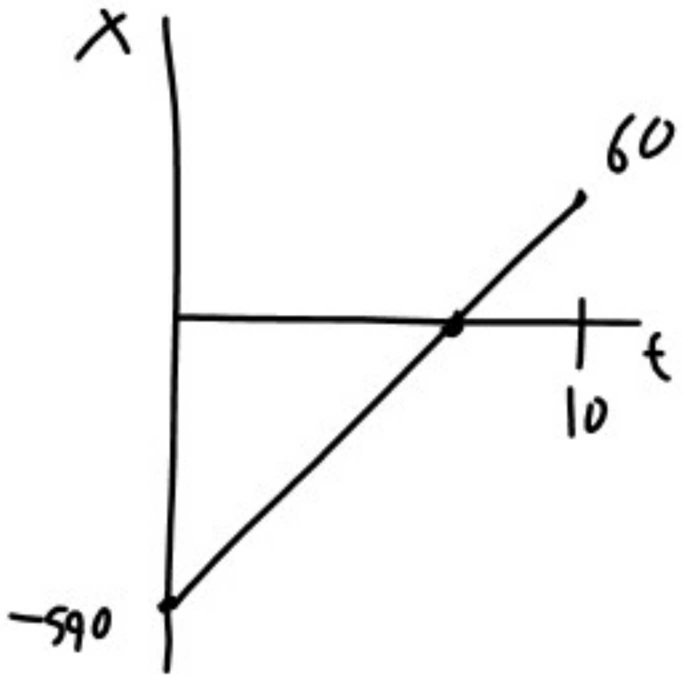
A particle moves in a straight line with the velocity shown in the figure. Knowing that $x = -540$ m at $t = 0$, (*a*) construct the a–t and x–t curves for $0 < t < 50$ s, and determine (*b*) the total distance traveled by the particle when $t = 50$ s, (*c*) the two times at which $x = 0$.





$$m = \frac{60+540}{10} = \frac{600}{10} = 60$$

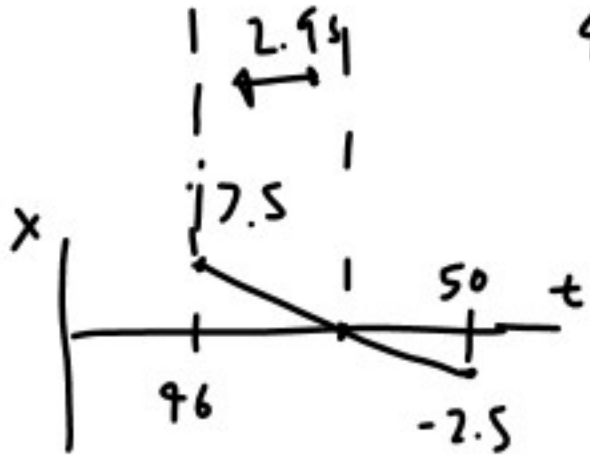
$$b = -540$$

$$x = mt + b$$

$$x = 60t - 540$$

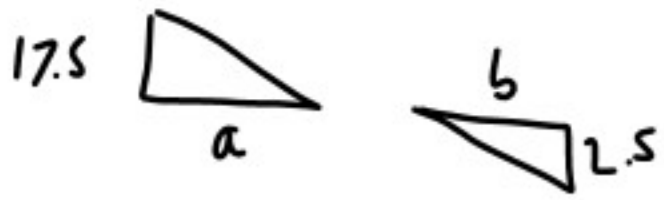
$$0 = 60t - 540$$

$$540 = 60t \Rightarrow t = \frac{540}{60} = \boxed{9\,s}$$



$$46 + 2.9$$

$$\boxed{48.9\,s}$$



$$a + b = 4$$

$$b = 4 - a$$

$$\frac{a}{17.5} = \frac{b}{2.5} = \frac{4-a}{2.5}$$

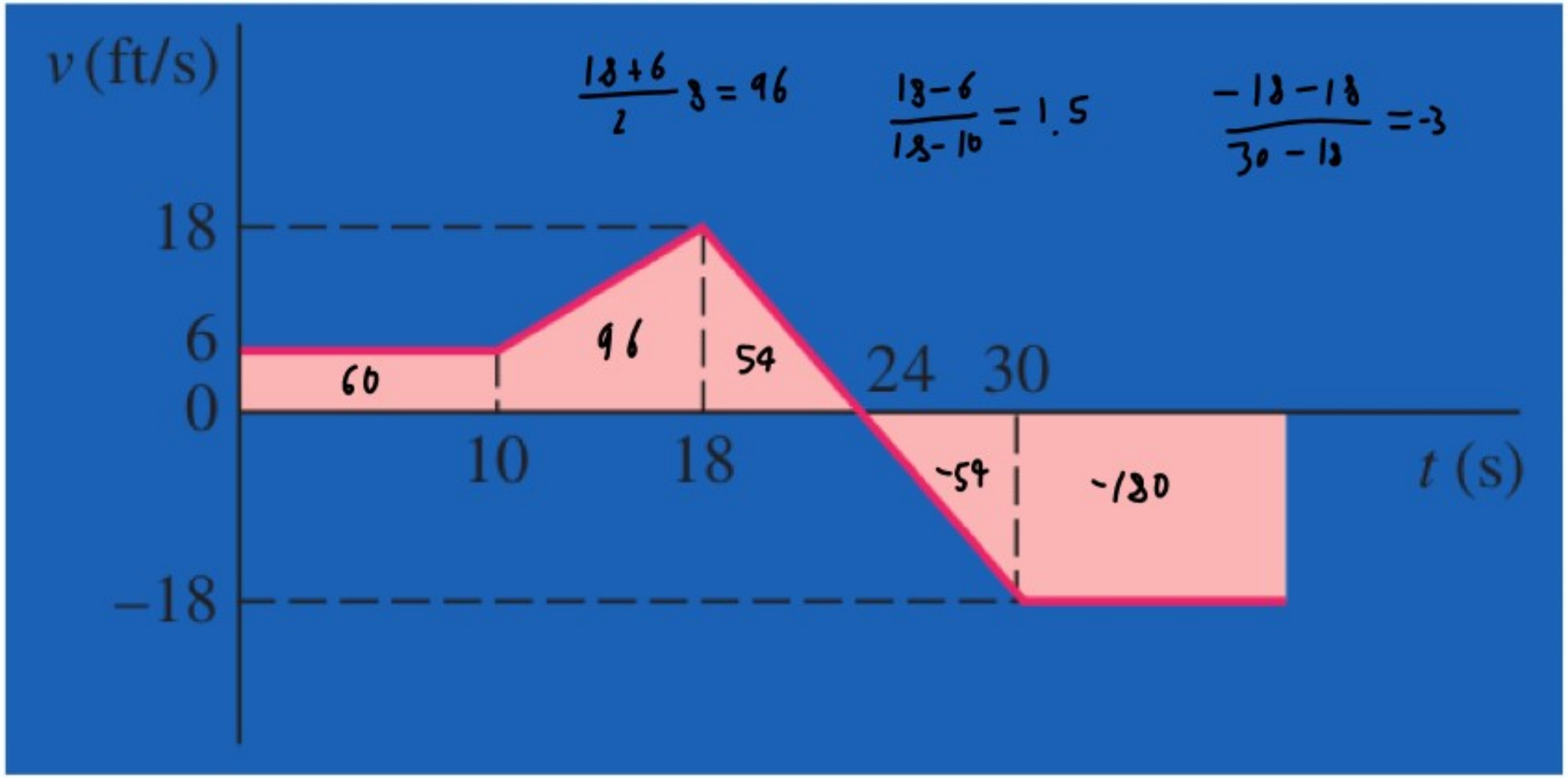
$$2.5a = 17.5(4-a) = 58 - 17.5a$$

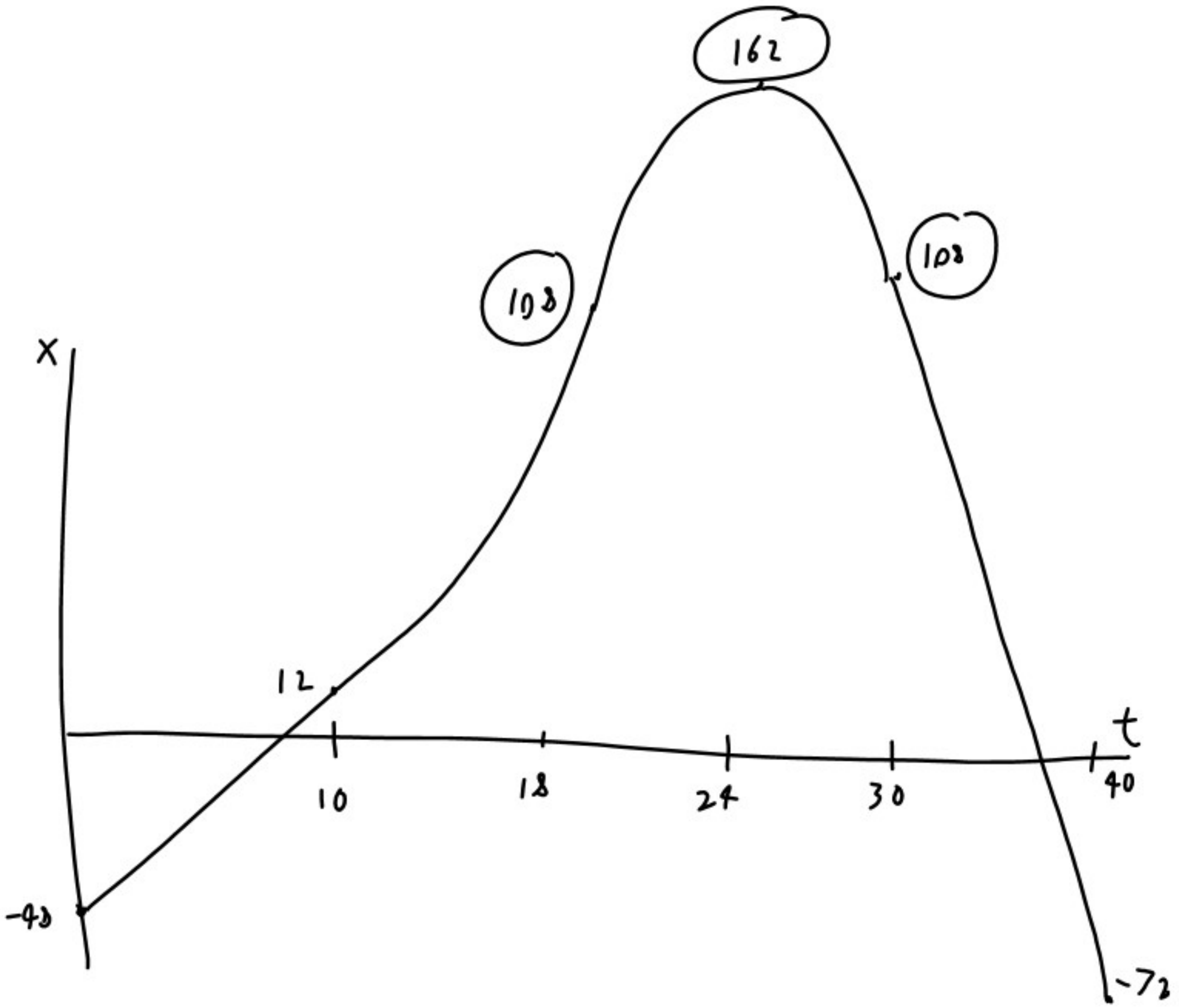
$$2.5a + 17.5a = 58$$

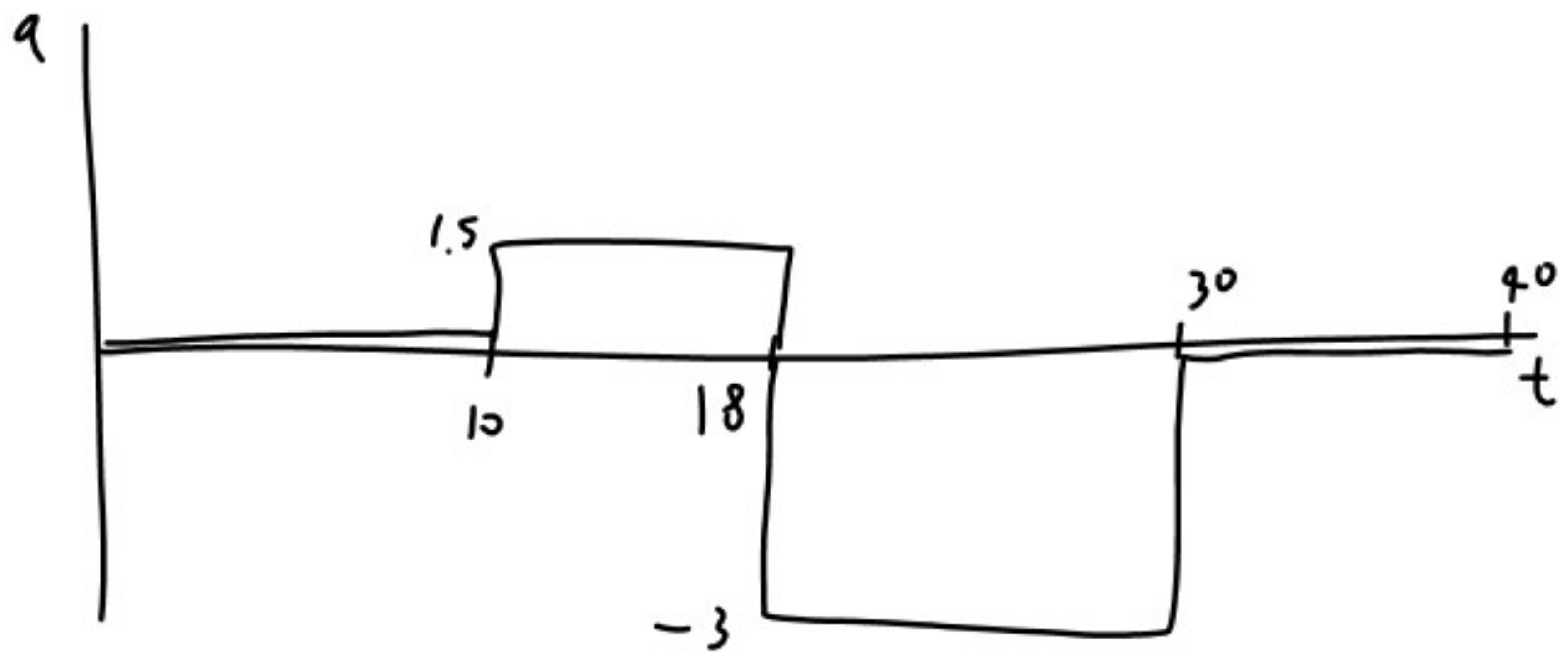
$$20a = 58$$

$$a = \frac{58}{20} = 2.9$$

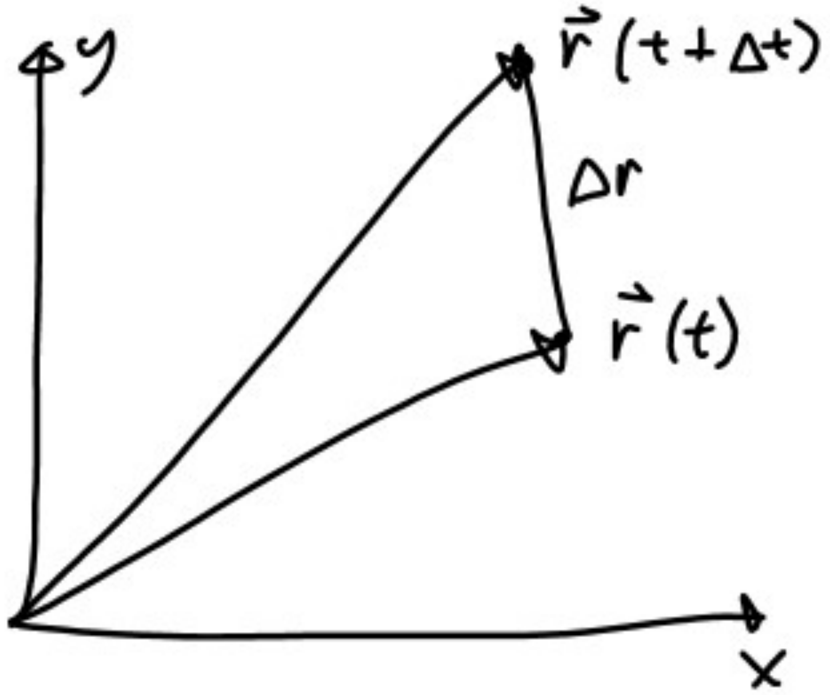
A particle moves in a straight line with the velocity shown in the figure. Knowing that $x = -48$ ft at $t = 0$, draw the a–t and x–t curves for $0 < t < 40$ s and determine (a) the maximum value of the position coordinate of the particle, (b) the values of t for which the particle is at a distance of 108 ft from the origin.




162
108
108
x
12
t
10
18
24
30
40
-48
-72


a
1.5
10
18
30
40
t
-3

$$V = \frac{dx}{dt}$$ x and v are scalars



avg $\vec{V} = \frac{\Delta \vec{r}}{\Delta t}$

$$\vec{V} = \lim_{\Delta t \to 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$$

$$\vec{a} = \frac{d\vec{v}}{dt}$$

speed vs velocity

speed is always scalar

always positive

speed $= |\vec{v}|$

$$\frac{d}{du}(\vec{P}+\vec{Q}) = \frac{d}{du}\vec{P} + \frac{d}{du}\vec{Q}$$

$$\vec{P}(u) \qquad f(u)$$

$$\frac{d}{du} f(u)\vec{P}(u) = \frac{df(u)}{du}\vec{P}(u) + f(u)\frac{d\vec{P}(u)}{du}$$

$$\vdots$$

$$\frac{d}{du}\vec{P}\cdot\vec{Q} = \frac{d\vec{P}}{du}\cdot\vec{Q} + \vec{P}\cdot\frac{d\vec{Q}}{du}$$

$$\frac{d}{du}\vec{P}\times\vec{Q} = \frac{d\vec{P}}{du}\times\vec{Q} + \vec{P}\times\frac{d\vec{Q}}{du}$$

$$\vec{P} = P_x i + P_y j + P_z K$$

$$\frac{d\vec{P}}{du} = \frac{dP_x}{du} i + \frac{dP_y}{du} j + \frac{dP_z}{du} K$$

$$\vec{V} = \frac{d\vec{r}}{dt}$$

$$= \frac{dr_x}{dt} i + \frac{dr_y}{dt} j + \frac{dr_z}{dt} K$$

$$= \dot{x} i + \dot{y} j + \dot{z} K$$

$$\vec{a} = \ddot{x} i + \ddot{y} j + \ddot{z} K$$