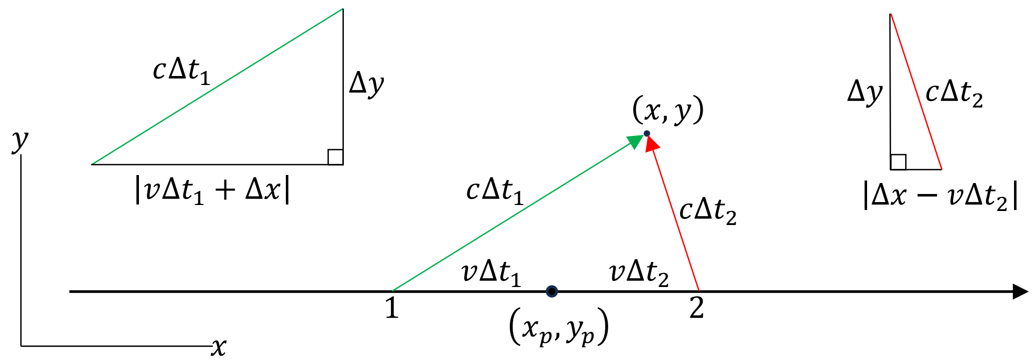
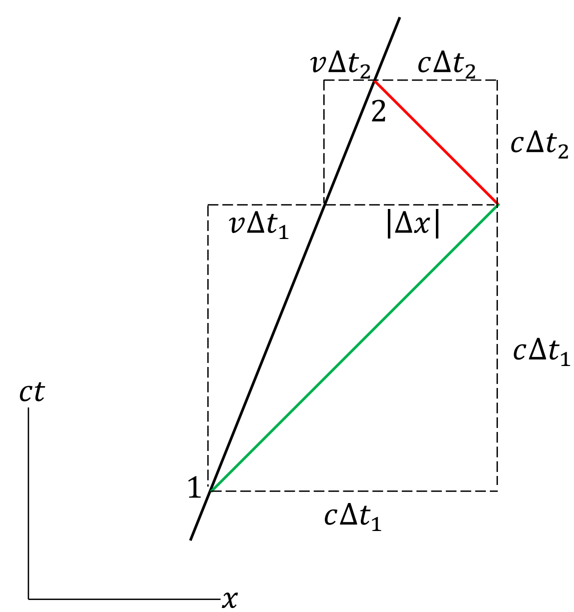


Retarded wave leaves particle when it is at 1 and arrives at (x, y) at time t
Advanced wave leaves particle when it is at 2 and arrives at (x, y) at time t

(x_p, y_p)	*particle position at time t*
(x, y)	*point on wave at time t*
Δx	$x - x_p$
Δy	$y - y_p$
t_1	*time when particle was at position 1*
t_2	*time when particle will be at position 2*
Δt_1	$t - t_1$
Δt_2	$t_2 - t$
x_1	*x position of particle at time 1* $= x_p - v\Delta t_1$
x_2	*x position of particle at time 2* $= x_p + v\Delta t_2$

$\Delta y = 0$ (*linear*)



$$c\Delta t_2 = |\Delta x| - v\Delta t_2$$
$$(c + v)\Delta t_2 = |\Delta x|$$
$$\Delta t_2 = |\Delta x|/(c + v)$$

$$c\Delta t_1 = v\Delta t_1 + |\Delta x|$$
$$(c - v)\Delta t_1 = |\Delta x|$$
$$\Delta t_1 = |\Delta x|/(c - v)$$

$$(c\Delta t_1)^2 = (\Delta y)^2 + (v\Delta t_1 + \Delta x)^2 = (\Delta y)^2 + v^2(\Delta t_1)^2 + 2v\Delta t_1\Delta x + (\Delta x)^2$$
$$c^2(\Delta t_1)^2 - v^2(\Delta t_1)^2 = (\Delta y)^2 + 2v\Delta t_1\Delta x + (\Delta x)^2$$
$$(c^2 - v^2)(\Delta t_1)^2 - 2v\Delta x\Delta t_1 - (\Delta y)^2 - (\Delta x)^2 = 0$$
$$(\Delta t_1)^2 - \frac{2v\Delta x}{(c^2 - v^2)}\Delta t_1 - \frac{(\Delta y)^2 + (\Delta x)^2}{(c^2 - v^2)} = 0$$

$$\Delta t_1 = \left\{\frac{2v\Delta x}{(c^2 - v^2)} \pm \sqrt{\left[\frac{2v\Delta x}{(c^2 - v^2)}\right]^2 + 4\frac{(\Delta y)^2 + (\Delta x)^2}{(c^2 - v^2)}}\right\}\Big/ 2$$
$$= \frac{1}{(c^2 - v^2)}\left[v\Delta x \pm \sqrt{v^2(\Delta x)^2 + (c^2 - v^2)[(\Delta y)^2 + (\Delta x)^2]}\right]$$
$$= \frac{1}{(c^2 - v^2)}\left[v\Delta x \pm \sqrt{v^2(\Delta x)^2 + c^2(\Delta y)^2 - v^2(\Delta y)^2 + c^2(\Delta x)^2 - v^2(\Delta x)^2}\right]$$
$$= \frac{1}{(c^2 - v^2)}\left[v\Delta x \pm \sqrt{(c^2 - v^2)(\Delta y)^2 + c^2(\Delta x)^2}\right]$$

$$\pm \Longrightarrow +$$

$$\boxed{\Delta t_1 = \frac{1}{(c^2 - v^2)}\left\{v(x - x_p) + \sqrt{(c^2 - v^2)(y - y_p)^2 + c^2(x - x_p)^2}\right\}}$$

$$\Delta x = 0 \implies \Delta t_1 = \frac{\sqrt{(c^2 - v^2)(\Delta y)^2}}{(c^2 - v^2)} = \frac{\Delta y}{\sqrt{c^2 - v^2}}$$
$$(\Delta t_1)^2 = \frac{(\Delta y)^2}{c^2 - v^2}$$
$$c^2(\Delta t_1)^2 - v^2(\Delta t_1)^2 = (\Delta y)^2$$
$$(c\Delta t_1)^2 = (v\Delta t_1)^2 + (\Delta y)^2 \quad \checkmark$$

$$v = 0 \implies \Delta t_1 = \frac{1}{c^2}\left[\sqrt{c^2(\Delta y)^2 + c^2(\Delta x)^2}\right]$$
$$(\Delta t_1)^2 = \frac{1}{c^4}[c^2(\Delta y)^2 + c^2(\Delta x)^2]$$
$$(c\Delta t_1)^2 = (\Delta y)^2 + (\Delta x)^2 \quad \checkmark$$

$$\Delta y = 0 \implies \Delta t_1 = \frac{1}{(c^2 - v^2)}\left[v\Delta x + \sqrt{c^2(\Delta x)^2}\right]$$
$$\Delta t_1 = \frac{v|\Delta x| + c|\Delta x|}{(c + v)(c - v)} = \frac{\Delta x}{c - v} \quad \checkmark$$

$$(c\Delta t_2)^2 = (\Delta y)^2 + (v\Delta t_2 - \Delta x)^2 = (\Delta y)^2 + v^2(\Delta t_2)^2 - 2v\Delta t_2\Delta x + (\Delta x)^2$$
$$c^2(\Delta t_2)^2 - v^2(\Delta t_2)^2 = (\Delta y)^2 - 2v\Delta t_2\Delta x + (\Delta x)^2$$
$$(c^2 - v^2)(\Delta t_2)^2 + 2v\Delta x\Delta t_2 - (\Delta y)^2 - (\Delta x)^2 = 0$$
$$(\Delta t_2)^2 + \frac{2v\Delta x}{(c^2 - v^2)}\Delta t_2 - \frac{(\Delta y)^2 + (\Delta x)^2}{(c^2 - v^2)} = 0$$

$$\Delta t_2 = \left\{\frac{-2v\Delta x}{(c^2 - v^2)} \pm \sqrt{\left[\frac{2v\Delta x}{(c^2 - v^2)}\right]^2 + 4\frac{(\Delta y)^2 + (\Delta x)^2}{(c^2 - v^2)}}\right\}\Big/2$$
$$= \frac{1}{(c^2 - v^2)}\left[-v\Delta xd \pm \sqrt{v^2(\Delta x)^2 + (c^2 - v^2)[(\Delta y)^2 + (\Delta x)^2]}\right]$$
$$= \frac{1}{(c^2 - v^2)}\left[-v\Delta x \pm \sqrt{v^2(\Delta x)^2 + c^2(\Delta y)^2 - v^2(\Delta y)^2 + c^2(\Delta x)^2 - v^2(\Delta x)^2}\right]$$
$$= \frac{1}{(c^2 - v^2)}\left[-v\Delta x \pm \sqrt{(c^2 - v^2)(\Delta y)^2 + c^2(\Delta x)^2}\right]$$

$$\pm \Longrightarrow +$$

$$\boxed{\Delta t_2 = \frac{1}{(c^2 - v^2)}\left\{-v(x - x_p) + \sqrt{(c^2 - v^2)(y - y_p)^2 + c^2(x - x_p)^2}\right\}}$$

$$\Delta x = 0 \Longrightarrow \Delta t_2 = \frac{\sqrt{(c^2 - v^2)(\Delta y)^2}}{(c^2 - v^2)} = \frac{\Delta y}{\sqrt{c^2 - v^2}}$$
$$(\Delta t_2)^2 = \frac{(\Delta y)^2}{c^2 - v^2}$$
$$c^2(\Delta t_2)^2 - v^2(\Delta t_2)^2 = (\Delta y)^2$$
$$(c\Delta t_2)^2 = (v\Delta t_2)^2 + (\Delta y)^2 \quad ✓$$

$$v = 0 \Longrightarrow \Delta t_2 = \frac{1}{c^2}\left[\sqrt{c^2(\Delta y)^2 + c^2(\Delta x)^2}\right]$$
$$(\Delta t_2)^2 = \frac{1}{c^4}[c^2(\Delta y)^2 + c^2(\Delta x)^2]$$
$$(c\Delta t_2)^2 = (\Delta y)^2 + (\Delta x)^2 \quad ✓$$

$$\Delta y = 0 \Longrightarrow \Delta t_2 = \frac{1}{(c^2 - v^2)}\left[-v\Delta x + \sqrt{c^2(\Delta x)^2}\right]$$
$$\Delta t_2 = \frac{-v|\Delta x| + c|\Delta x|}{(c + v)(c - v)} = \frac{\Delta x}{c + v} \quad ✓$$