4.6) For a given hypothetical flow, the velocity from t=5s to t=10s, the velocity was u=3m/s, V=-4m/s. A dye streak was started at a point in the flow field at t=0 and the path of a particle in the fluid was also traced from that same point starting at the same time. Draw to skale the streakline, pathline of the particle, and streamlines @ time t=10s

GIVEN:

A dye streak was started, and a particle was released.

For $0 \le t \le 5s$, $u = 2m/s$, $v = 0$
For $5 \le t \le 10s$, $u = 3m/s$, $v = -4m/s$

UNKNOWN:

For t=10s, draw to scale the streakline, pathline of the particle, and streamlines.

SOLUTION:

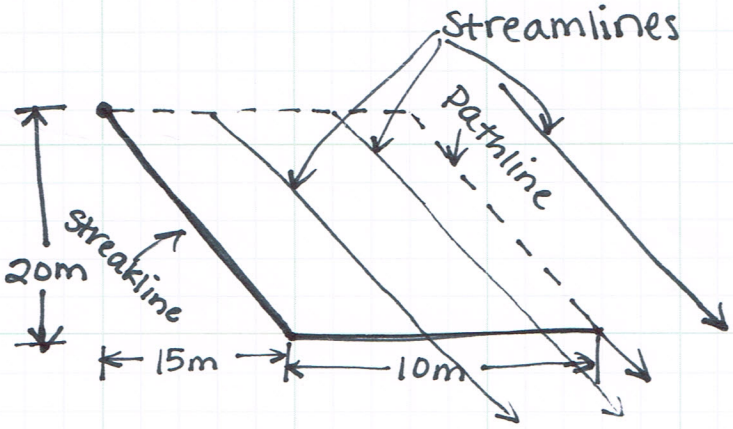
From $0<t<5$, the dye in the streakline moved to the right for a distance of 10m.

At the same time a particle is released from the orgin and travels 10m to the right.

From $5<t<10$, the original line of dye is transported in whole downward to the right while more dye is released from the origin.

The pathline of the particle proceeds from its location at t=5sec downward to the right.

At 10sec, the streamlines are



4.8) A ~~fe~~ velocity field is given mathematically as

$V = 2i + 4yj$

The field is:

Velocity

a) 1D in x

b) 1D in y

c) 2D in x and y

Solutions:

The vector (i & j) is representing a field that varies in 2 dimensions.

Answer is C

4.30) Liquid flows through this two-dimensional slot with a velocity of $V = 2\left(\frac{q_0}{b}\right)\left(\frac{t}{t_0}\right)$, where q_0 and t_0 are reference values. What will be the local acceleration at $x = 2B$ and $y = 0$ in terms of B, t, t_0, and q_0?

KNOWN:

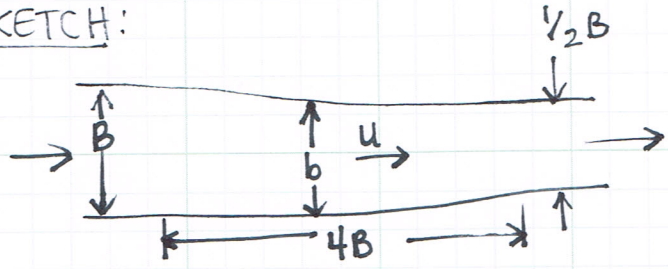
Flow in a two-dimensional slot.

$$V = 2\left(\frac{q_0}{b}\right)\left(\frac{t}{t_0}\right)$$

$x = 2B$

$y = 0$ in

SKETCH:



UNKNOWN:

An expression for local acceleration midway in nozzle.

SOLUTION:

$$V = 2\left(\frac{q_0}{b}\right)\left(\frac{t}{t_0}\right)$$

where $b = B/2$

$$V = 4\left(\frac{q_0}{B}\right)\left(\frac{t}{t_0}\right)$$

$$a_l = \frac{\partial V}{\partial t}$$

at the end of the nozzle →

$$\boxed{a_l = \frac{4q_0}{Bt_0}}$$

midway

$$a_l = \frac{dV}{dt} = \left[\frac{2q_0 \cdot t}{t_0(1/8\,x)}\right] = \frac{2q_0}{t_0(1/8\,x)}$$

$x = 2B$

$$\Rightarrow a_l = \frac{2q_0}{t_0(B - B/2(2B/4B))}$$

$$= \frac{2q_0}{t_0(B - B/4)}$$

$$\boxed{a_l = \frac{8}{3}\left(\frac{q_0}{t_0 B}\right)}$$