**••8** Figure 16-32 shows the transverse velocity *u* versus time *t* of the point on a string at *x* = 0, as a wave passes through it. The scale on the vertical axis is set by *us* = 4.0 m/s. The wave has the generic form *y*(*x*, *t*) = *ym* sin (*kx* - ω*t +* φ). What then is φ? (*Caution:* A calculator does not always give the proper inverse trig function, so check your answer by substituting it and an assumed value of ω into *y*(*x*, *t*) and then plotting the function.)

 

Since $y\left(x,t\right)= y\_{m}sin(kx-wt+φ)$ then it reperesent a wave moving toward the +x-axis.

$$and u\left(x,t\right)= -y\_{m}w cos\left(kx-wt+φ\right)=-u\_{m}cos⁡(kx-wt+φ)$$

 $From the graph u\_{m}=5 m/s$

At x = and t = 0

 $y\left(0,0\right)=y\_{m}sin(φ)$ ----------------------- (1)

 $and u\left(0,0\right)=-u\_{m}cos\left(φ\right)=- 4.0$

$$⇒ \cos(\left(φ\right))=\frac{4}{5} ⇒ φ=37^{o} $$

$$ or φ=360-37=323^{o}$$



u = 0

u > 0

y(t)

u > 0

t

From the graph, the value of u at t = 0 is negative. From the above graph of possible y curves The blue is the correct one since it gives u <0 at t = 0 therefore y(0,0) < 0 and from equation (1) $φ=323^{o}$ since sin(323)<0>