A $\langle 5\hat{i} + 4\hat{j} \rangle$

B $\langle -3\hat{i} + 5\hat{j} \rangle$

A+B

$5\hat{i}$ $4\hat{j}$

$-3\hat{i}$ $5\hat{j}$

$2\hat{i}$ $9\hat{j}$

component vector: $\langle 2\hat{i} + 9\hat{j} \rangle$

x y

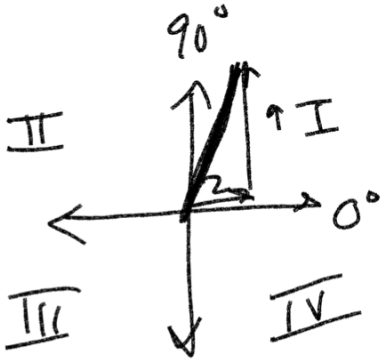
resultant/magnitude: $r = \sqrt{x^2 + y^2}$

$\sqrt{(2)^2 + (9)^2} = \sqrt{4+81} = \sqrt{85} =$ 9.2

direction:

$\theta = \tan^{-1} \frac{y}{x}$

$\tan^{-1} \frac{9}{2} = 77.5°$



9.2, 77.5°

A: $\langle 6\hat{i} + 4\hat{j} - 8\hat{k} \rangle$

B: $\langle -3\hat{i} + 3\hat{j} \rangle$

C: $\langle -9\hat{i} - 4\hat{k} \rangle$

component (unit) vector: $\hat{i}$ $\hat{j}$ $\hat{k}$

A + B + C

$6\hat{i} + (-3\hat{i}) + (-9\hat{i}) = -6\hat{i}$

$4\hat{j} + 3\hat{j} = 7\hat{j}$

$-8\hat{k} + (-4\hat{k}) = -12\hat{k}$

Resultant: $\boxed{\langle -6\hat{i} + 7\hat{j} - 12\hat{k} \rangle}$

$$r = \sqrt{x^2 + y^2 + z^2}$$

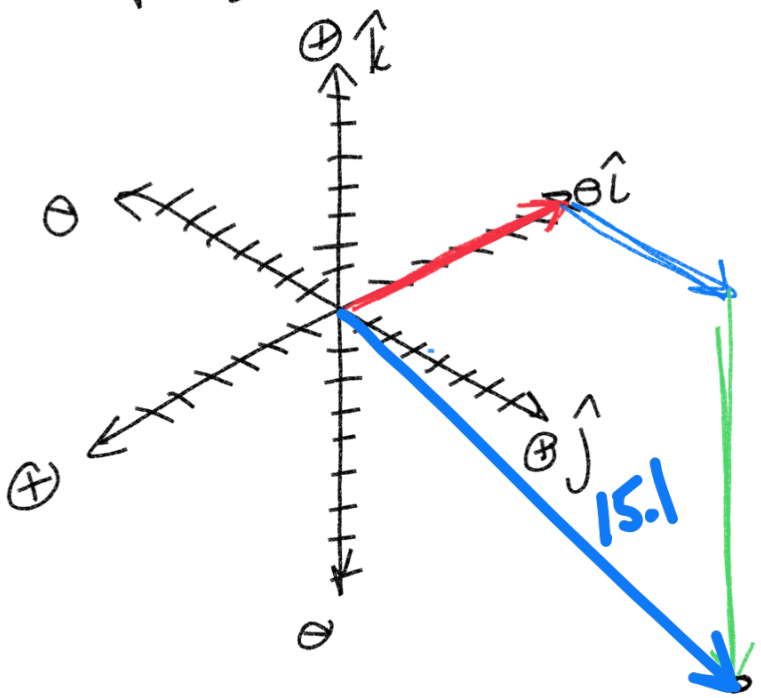
$$\sqrt{(-6)^2 + (7)^2 + (-12)^2}$$

$$\sqrt{36 + 49 + 144} = \sqrt{229} \approx \boxed{15.1}$$

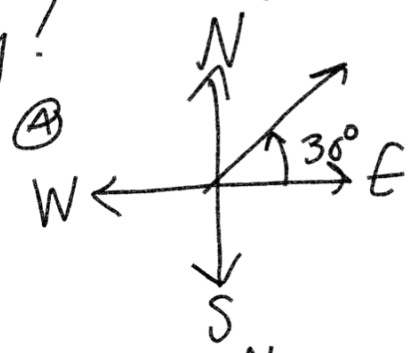
$\hat{i} \rightarrow -6\hat{i}$

$\hat{j} \rightarrow 7\hat{j}$

$\hat{k} \rightarrow -12\hat{k}$



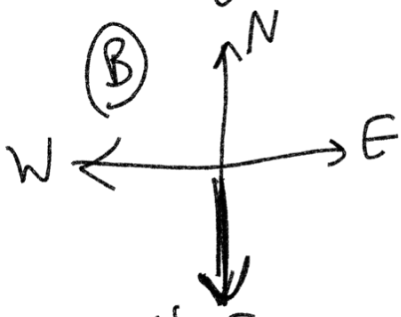
Bryler is looking for a place to deposit Nate's body. He drove 5.2 miles 30° North of East, headed south for 3.5 miles, and finally turned 40° West of South for 8 miles. How did Bryler kill Nate? And where is the body?



(A) 5.2 mi 30° N of E $\theta = 30°$

(B) 3.5 mi S $\theta = 270°$

(C) 8 mi 40° W of S $\theta = 230°$

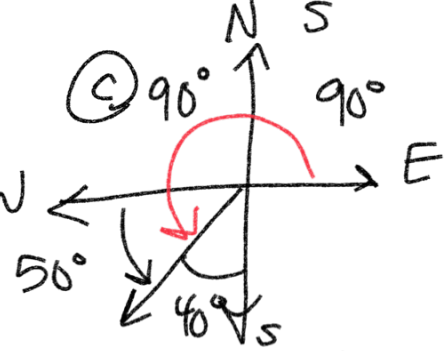


$x = r\cos\theta$ $y = r\sin\theta$

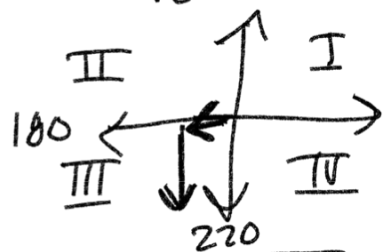
(A) $5.2\cos 30° = 4.5$ $5.2\sin 30° = 2.6$

(B) $3.5\cos 270° = 0$ $3.5\sin 270° = -3.5$ W

(C) $8\cos 230 = -5.1$ $8\sin 230 = -6.1$



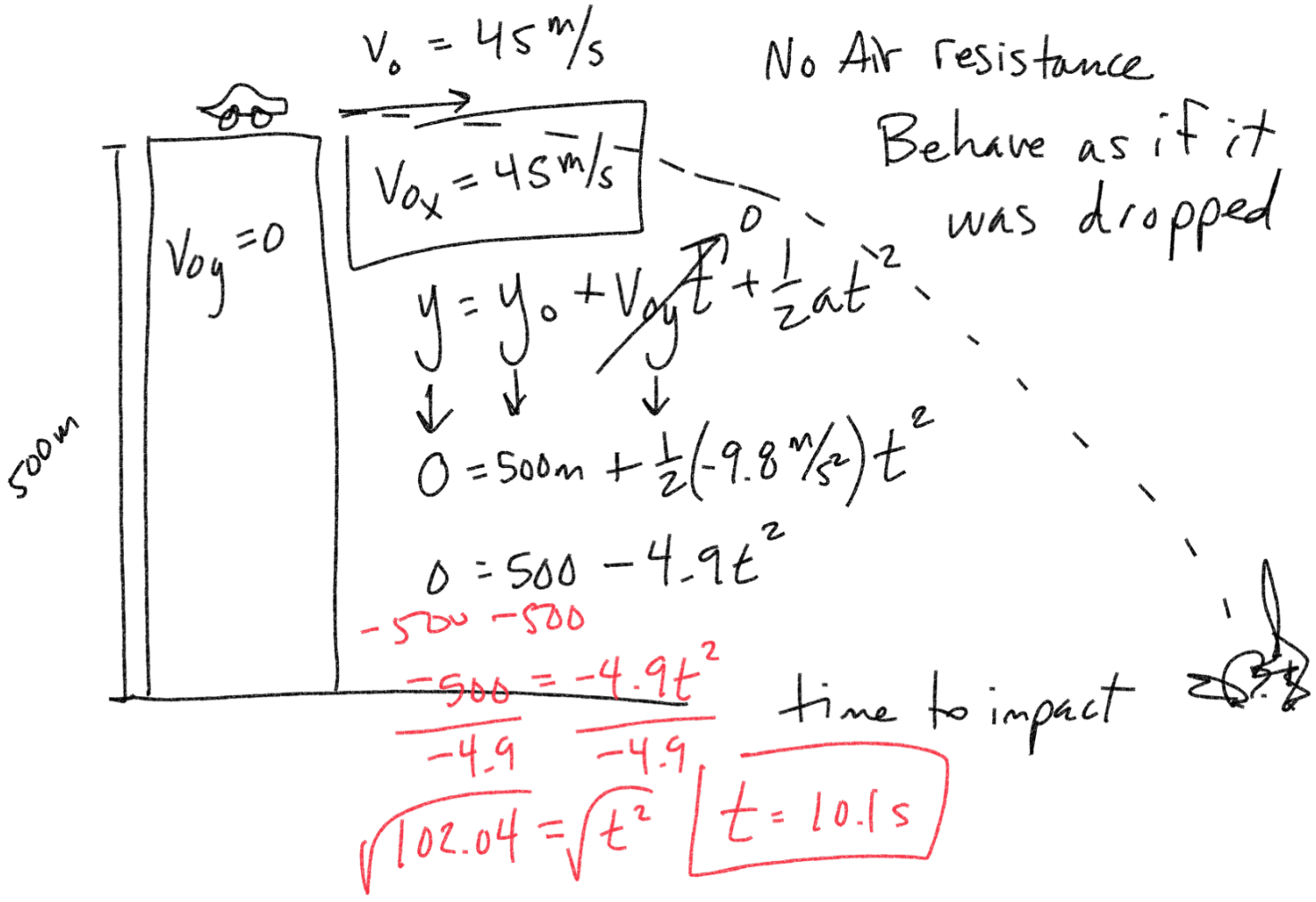
-0.6 mi -7 mi



component form: $\langle -0.6\hat{i} - 7\hat{j} \rangle$

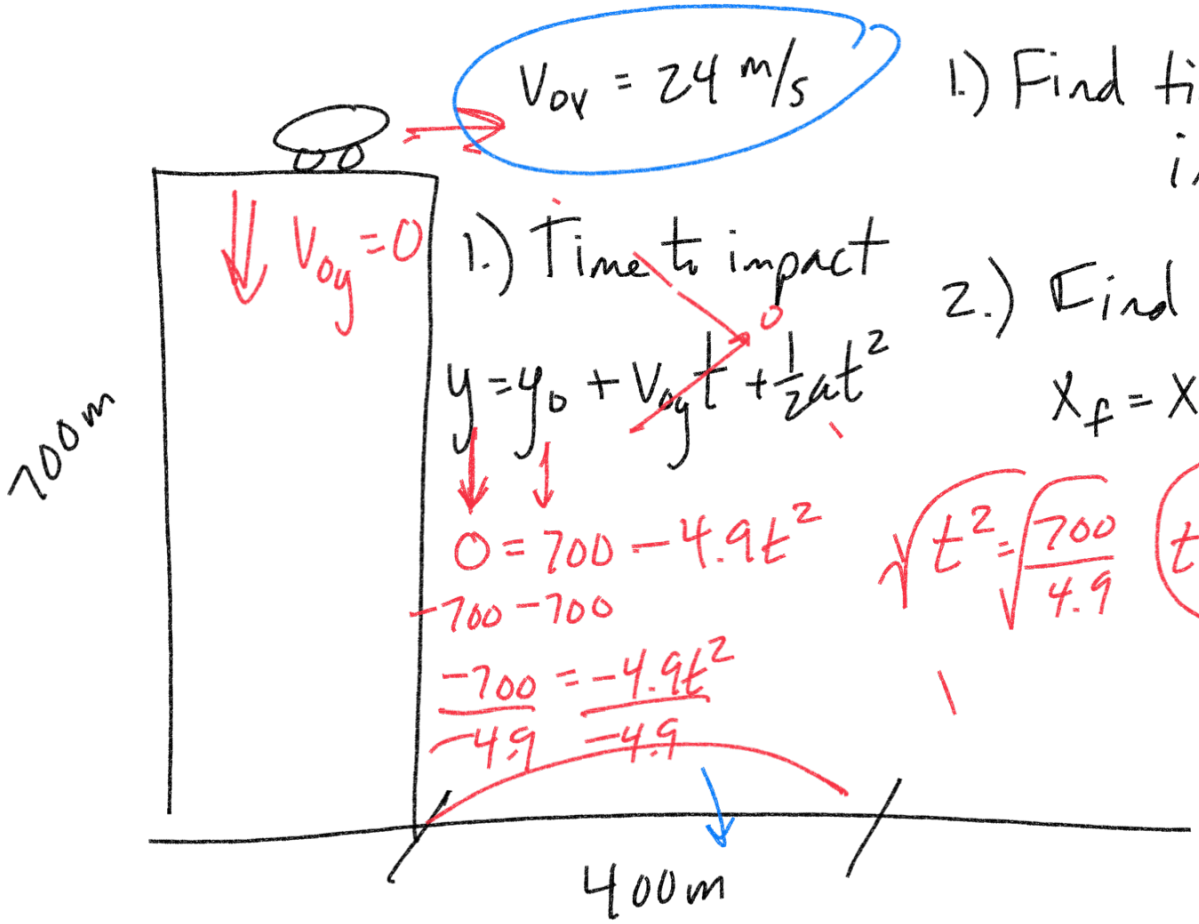
$r = \sqrt{(-0.6)^2 + (-7)^2} = \sqrt{0.36 + 49} = \sqrt{49.36} = \boxed{7.0 \text{ mi}}$

$\theta = \tan^{-1}\frac{-7}{-0.6} = 85.1° + 180 = 265.1°$ $\boxed{7 \text{ mi}, 265.1°}$



$$X_f = X_o + V_{ox}t$$

$$= (45\ m/s)(10.1\ s) = 454.5\ m$$



1.) Find time to impact

2.) Find distance

1.) Time to impact

$y = y_0 + V_{0y}t + \frac{1}{2}at^2$

$0 = 700 - 4.9t^2$

$-700 \quad -700$

$\frac{-700}{-4.9} = \frac{-4.9t^2}{-4.9}$

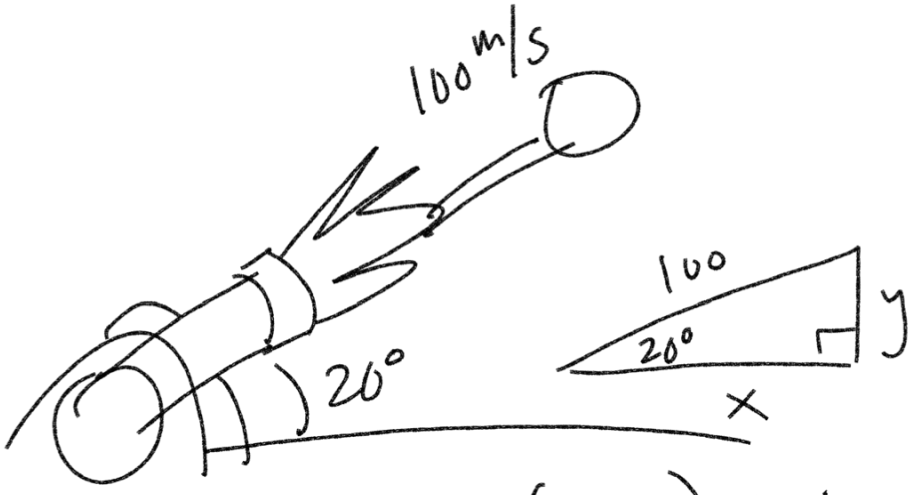
$\sqrt{t^2} = \sqrt{\frac{700}{4.9}}$

$t = 11.95\ s$

$X_f = X_0 + V_{0x}t$

$X_f = X_0 + V_{0x}t$

$0 + (24\ m/s)(11.95\ s) = 286\ m$



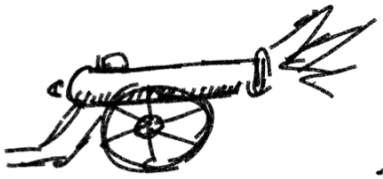
$X = r\cos\theta$

$V_{0x} = V_0\cos\theta$

$V_{0y} = V_0\sin\theta$

$100\left(\cos 20^\circ\right) = \left(\frac{X}{100}\right)100$

$X = 100\cos 20^\circ$



1.) Time to impact

$$y = y_0 + V_{0y}t - 4.9t^2$$

$$y = \cancel{y_0}^{0} + (V_0 \sin\theta)t - 4.9t^2$$

$$0 = (100 \sin 20)t - 4.9t^2$$

$$-100 \sin 20t - 100(\sin 20)t$$

$$\cancel{-100 \sin 20t} = -4.9t^{\cancel{2}}$$

$$\frac{-100 \sin 20}{-4.9} = \frac{-4.9t}{-4.9}$$

$$7s = t$$

Distance

$$V_0 = V_x$$

$$x = x_0 + V_{0x}t$$

$$\cancel{x_0}^{0} + (V_0 \cos\theta)t$$

$$(100 \cos 20)(7) = \boxed{658\ m}$$