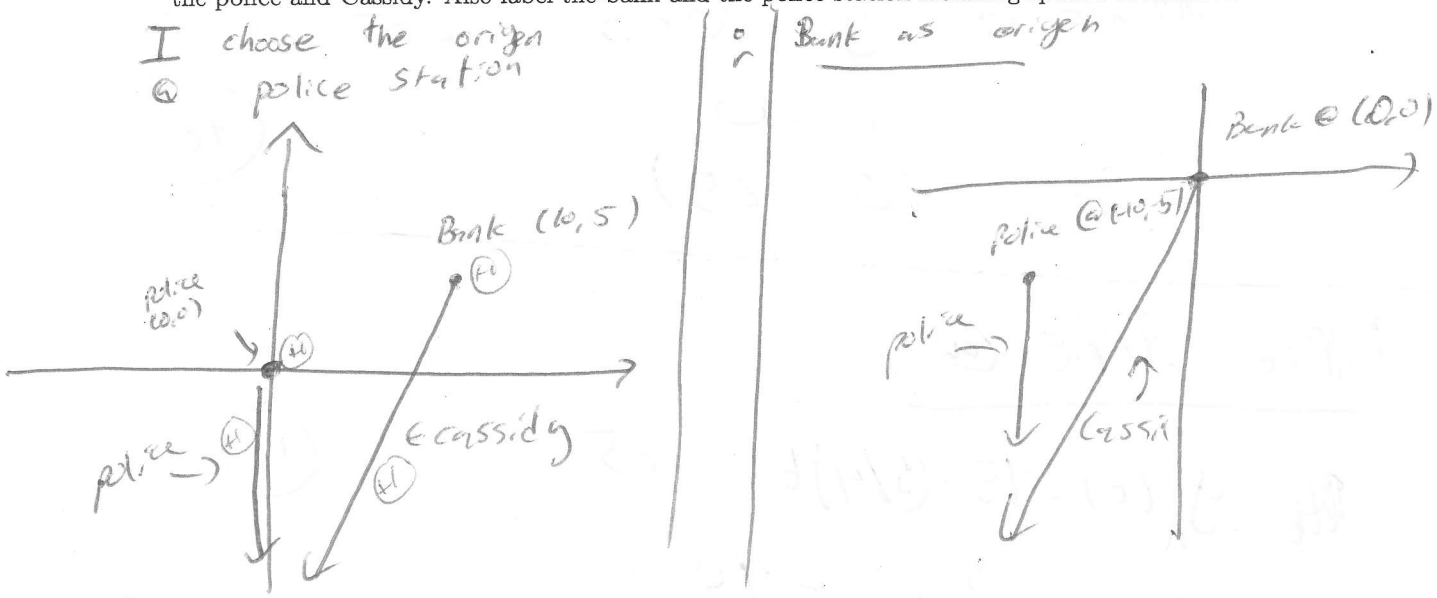
Math 120 B Quiz 2 (20 minutes) April 12, 2017

Name: Key

Answer the questions in the spaces provided. Show all necessary work. If you have any questions, raise your hand and I will come try to answer.

1. There is a bank, located 10 miles east, and 5 north, of the police station in Mission City. Butch Cassidy robbed the bank, and started running for the Mexican border. He traveled in a straight line, going 1 mile ~~east~~ west for every 3 he went south, traveling at 60 miles per hour. 12 minutes after the robbery, police leave the station and head due south to try and catch him, traveling at 75 miles per hour. (NOTE: It may be easier to work in minutes than hours.)

   (a) (5 points) Choose a coordinate system, and draw a picture of the situation. Label the paths of both the police and Cassidy. Also label the bank and the police station including specific coordinates.

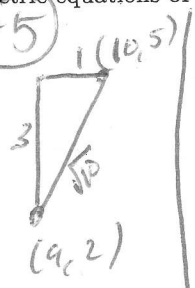


   (b) (8 points) Find parametric equations of motion for both Cassidy, and the police.

Cassidy 60 mph = 1 mile/min (+5)

(i) $t=0$ $(x(t), y(t)) = (10, 5)$

(ii) $t=\sqrt{10}$ $(x(t), y(t)) = (9, 2)$



(i) $\Rightarrow x(t) = 10 + at$

$y(t) = 5 + bt$

(ii) $9 = 10 + a\sqrt{10}$

so $a = -1/\sqrt{10}$

$2 = 5 + b\sqrt{10}$

$\Rightarrow b = -3/\sqrt{10}$

so

$x_c(t) = 10 - \frac{1}{\sqrt{10}} t$

$y_c(t) = 5 - \frac{3}{\sqrt{10}} t$

Police 75 mph = 1.25 mile/min (+3)

Vertical so $x_p(t) = 0$

$y_p(12) = 0$

$y_p(16) = -5$ | in four minutes 5 miles south

Slope: $\frac{\Delta y}{\Delta t} = \frac{-5}{4}$

$y = -\frac{5}{4}(t-12) = -\frac{5}{4}t + 15$

so $x_p(t) = 0$

$y_p(t) = 15 - \frac{5}{4}t$

(c) (7 points) Do the police catch Cassidy? (HINT: Their paths should only cross once, who gets there first?)

Step 1 Find intersection point.

Lines: $x = 0$ ← police

$y = 3(x-10)+5$ ← Cassidy

intersect @ $y = -30+5 = -25$

$x = 0$ (+2)

So $(0, -25)$

Police Arrive @...

$y_p(t) = 15 - (5/4)t = -25$ (+2)

So $\frac{-5}{4}t = -40$

So $t = 32$

Cassidy Arrives @...

$x_c(t) = 10 - \frac{1}{\sqrt{10}}t = 0$ (+2)

$t = 10\sqrt{10} \approx 31.6 < 32$

Cassidy Narrowly escapes (+1)