

# Math 152 - Section C2 - Summer 2013

## Workshop 10

Instructor Pat Devlin

Worked on Thursday July 11, 2013 — Due Wednesday July 17, 2013

**Problem 1:** The yellow angry bird<sup>1</sup> has the special property that at any time during its flight, you can give him an instant ‘burst’ of speed. This has the effect of drastically changing his trajectory. In fact, it makes him go so fast that the moment this ability is activated, his flight from that point onward just follows the line that was tangent to his trajectory at the time of activation<sup>2</sup> [ask Pat if this is unclear!].

Now let’s say that the yellow bird is fired in such a way that if his ability were never activated, then his flight would follow the parabolic path

$$\begin{cases} x(t) = 2t \\ y(t) = 6t - t^2 \end{cases} .$$

Here,  $t$  is the number of seconds after being released (so at  $t = 0$ , he’s at the start of his flight), and suppose the area he is being shot at is a level area with the ground at  $y = 0$ .

- (a) Make a quick sketch of this situation.
- (b) If his ability is never activated, then how long would the yellow bird remain in the air until it hits the ground? At which time would its altitude be maximized?
- (c) If his ability is never activated, then where would the yellow bird hit the ground? What would be its speed on impact?
- (d) Suppose the bird’s ability is activated when  $t = 4$ . Where would the bird be at that time? What would be the slope of the line tangent to its trajectory at that time?
- (e) Complete the following table to find out where the bird would land if his ability is activated at different times. The first row has been done for you.

Time $t$ of activation	$dy/dx$	Position at activation	Equation for tangent line	Site of impact
$t = 4$	$-1$	$(x(4), y(4)) = (8, 8)$	$y - 8 = -1(x - 8)$	Impact at $(16, 0)$
$t = 4.5$				
$t = 5$				
$t = 5.5$				

- (f) At what time should the bird’s ability be activated to directly hit a pig located at  $(12.5, 0)$ ?

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<sup>1</sup>The yellow bird is named “Chuck” by Rovio.

<sup>2</sup>In truth, this is a slight approximation since he actually still seems to be affected by gravity after activation.

**Problem 2:** Approximate  $3 + 8$  and argue that your answer is within  $10^{-10}$  of the actual value.

**Problem 3:** Alice thinks apples are better than oranges, but Bob thinks they can't be compared. Considering that Alice and Bob just started dating, is this disagreement something that you think may cause issues in their relationship? Support your answer.