

Name: *Solution*

Student Number:

## Problem 1

Why is it difficult to find the equation of a tangent line? How could we overcome such a difficulty?

- (1) We will be able to find an equation of the tangent line as soon as we know its slope  $m$ . The difficulty is that we know only one point, whereas we need two points to compute the slope.
- (2) We can estimate the slope of the tangent line with slopes of secant lines.

## Problem 2

If a ball is thrown into the air with a velocity of 40 ft/s, its height in feet  $t$  seconds later is given by

$$s(t) = 40t - 16t^2$$

- (a) Write a general formula for the average velocity of a particle over the time interval  $[2, 2+h]$ .

$$\begin{aligned} \text{Average velocity} &= \frac{\text{change in position}}{\text{Time elapsed}} = \frac{\text{Distance travelled}}{\text{Time elapsed}} \\ &= \frac{s(2+h) - s(2)}{(2+h) - 2} \\ &= \frac{40(2+h) - 16(2+h)^2 - 16}{h} \end{aligned}$$

- (b) Use part (a) to compute the average velocity for the time period beginning when  $t = 2$  and lasting

- (i)  $h = 0.5$  seconds      (ii)  $h = 0.1$  seconds  
 (iii)  $h = 0.05$  seconds      (iv)  $h = 0.01$  seconds

| $h$  | Average velocity for $[2, 2+h]$ |
|------|---------------------------------|
| 0.5  | -32 ft/s                        |
| 0.1  | -25.6 ft/s                      |
| 0.05 | -24.8 ft/s                      |
| 0.01 | -24.16 ft/s                     |

- (c) Estimate the instantaneous velocity when  $t = 2$ .

It looks like instantaneous velocity at  $t=2$  is  
 -24 ft/s