

CALCULUS  
Average rates of change  
OLD

0130-1. Water is being added to a tub, and the amount in the tub is constantly monitored, and is tabulated against time as follows:

hrs:	3	6	9	12
liters:	55	100	135	180

Let  $W$  be the amount in the tank at time  $t$ .

Let  $B = (6, 100)$ , a point on the graph of  $W$ .

a. Find the slope of the secant lines between  $B$  and the other points on the graph of  $W$  appearing in the table above.

b. Estimate the slope of the tangent line to the graph of  $W$  at the point  $B$ , by averaging the following two numbers:  
the slope of the secant line between  $B$  and  $(3, 55)$   
and the slope of the secant line between  $B$  and  $(9, 135)$ .

OLD 0130-2. Let  $A$  be the point  $(2, 7)$  on the graph of  $y = x^3 - 1$ . Let  $B$  be a variable point  $(x, x^3 - 1)$  on the same graph.

a. Compute the slope of the secant line between  $A$  and  $B$ , when  $x$  is equal to

- |                                 |          |            |
|---------------------------------|----------|------------|
| (i) 3                           | (ii) 2.1 | (iii) 2.01 |
| (iv) 1                          | (v) 1.9  | (vi) 1.99  |
| (vii) $2 + h$ , with $h \neq 0$ |          |            |

b. Guess the slope of the tangent line to  $y = x^3 - 1$  at  $A$ .

c. Using b, write an equation of the tangent line to  $y = x^3 - 1$  at  $A$ .

<sup>OLD</sup> 0130-3. A tennis player, in a fit of rage over a lost point, throws his racquet into the air. Assume that its distance, in feet, above the ground,  $t$  seconds later, is  $70t - 16t^2$ .

a. Find its average velocity over the time period starting at time 3, and continuing for the following number of seconds:

- |   |            |              |
|---|------------|--------------|
| (i) 1                                     | (ii) 0.5   | (iii) 0.01   |
| (iv) 0.001                                | (v) 0.0001 | (vi) 0.00005 |
| (vii) $\Delta t$ , with $\Delta t \neq 0$ |            |              |

b. Guess its instantaneous velocity 3 seconds after it's thrown.