

In order to receive full credit, you must **show all your work** and simplify your answers.

Consider the function  $f(x) = x^2 + 3x + 2$ .

1. (1 point) What is  $f(2)$ ? Show your calculation:

**Solution:**  $f(2) = 2^2 + 3(2) + 2 = 4 + 6 + 2 = 12$

2. (4 points) Write down and simplify  $f(a + h)$ . Use that to write down and simplify  $f(a + h) - f(a)$ .

**Solution:**

$$f(a + h) = (a + h)^2 + 3(a + h) + 2 = a^2 + 2ah + h^2 + 3a + 3h + 2$$

$$f(a + h) - f(a) = (a^2 + 2ah + h^2 + 3a + 3h + 2) - (a^2 + 3a + 2) = 2ah + h^2 + 3h$$

3. (2 points) Use your answer from #2 to write down and simplify the difference quotient:

**Solution:**

$$m_{sec} = \frac{f(a + h) - f(a)}{h} = \frac{2ah + h^2 + 3h}{h} = \frac{h(2a + h + 3)}{h} = 2a + h + 3$$

4. (1 point) Why do we use the notation  $m_{sec}$  for the difference quotient above?

**Solution:** We use the notation  $m_{sec}$  for the difference quotient because it represents the slope  $m$  of the secant line, i.e., the line passing through the points  $(a, f(a))$  and  $(a + h, f(a + h))$  on the graph  $y = f(x)$ : the numerator of the difference quotient is the “rise” (the vertical distance between the two points, and the denominator  $h$  is the run (the horizontal distance).

5. (2 points) Shown below is the graph of  $y = x^2 + 3x + 2$ . Label the  $x$ -intercepts and the point  $(2, f(2))$  on the graph with their coordinates:

