PRINT Your Name:_____

Remove everything from your desk except this page and a pencil or pen.

Circle your answer. **Show your work.** Check your answer!
The quiz is worth 5 points.

Compute $\int \dfrac{3x^2 + 8x + 10}{x^3 + 2x^2 + 5x} dx$. **Check your answer.**

Answer: Muliply both sides of

$$\frac{3x^2 + 8x + 10}{x(x^2 + 2x + 5)} = \frac{A}{x} + \frac{Bx + C}{x^2 + 2x + 5}$$

by $x(x^2 + 2x + 5)$ to see that:

$$3x^2 + 8x + 10 = A(x^2 + 2x + 5) + (Bx + C)x$$

$$3x^2 + 8x + 10 = (A + B)x^2 + (2A + C)x + 5A$$

Eqauate the corresponding coefficients:

$$3 = A + B, \quad 8 = 2A + C, \quad 10 = 5A;$$

hence, $A = 2$, $C = 4$, and $B = 1$. Check that

$$\frac{2}{x} + \frac{x + 4}{x^2 + 2x + 5} = \frac{2x^2 + 4x + 10 + x^2 + 4x}{x^3 + 2x^2 + 5x} = \frac{3x^2 + 8x + 10}{x^3 + 2x^2 + 5x}.$$

Before we integrate, we see that

$$x^2 + 2x + 5 = x^2 + 2x + 1 + 4 = (x + 1)^2 + 4$$

The problem is

$$\int \frac{2}{x} + \frac{x + 4}{x^2 + 2x + 5} dx = \int \frac{2}{x} + \frac{x + 1}{(x + 1)^2 + 4} + \frac{3}{(x + 1)^2 + 4} dx$$

$$= \boxed{2 \ln |x| + \frac{1}{2} \ln((x + 1)^2 + 4) + \frac{3}{2} \arctan\left(\frac{x + 1}{2}\right) + C}$$