HW12 MATH 3520 Fall 2019

A) $\left\langle \begin{bmatrix} 5 \\ 2 \\ -1 \end{bmatrix}, \begin{bmatrix} 2 \\ 1 \\ -1 \end{bmatrix} \right\rangle = 5(2)+2(1)+(-1)(-1) = 10+2+1 = 13$

B) $\langle 2x-1, 8 \rangle = \int_0^\infty (2x-1)(8)e^{-x}\,dx = 8$

↑ used calculator

C) $\langle x^2+1, x+7 \rangle = \int_0^1 (x^2+1)(x+7)\,dx = \int_0^1 x^3+7x^2+x+7\,dx$

$= \frac{x^4}{4} + \frac{7x^3}{3} + \frac{x^2}{2} + 7x \Big|_0^1$

$= \frac{1}{4} + \frac{1}{3} + \frac{1}{2} + 7$

E) $\langle 4x^2+3x+9, 1 \rangle = 4\langle x^2, 1 \rangle + 3\langle x, 1 \rangle + 9\langle 1, 1 \rangle$

$= 4\left(\frac{\sqrt{\pi}}{2}\right) + 3(0) + 9\sqrt{\pi}$

$= 11\sqrt{\pi}$

$\langle 32x^5-64x^3+24x, 1 \rangle = 32\langle x^5, 1 \rangle - 64\langle x^3, 1 \rangle + 24\langle x, 1 \rangle$

$= 0+0+0$

$= 0$

F) $\underset{x^2-3x}{\text{proj}}\,(5x+2) = \dfrac{\langle 5x+2,\, x^2-3x\rangle}{\langle x^2-3x,\, x^2-3x\rangle}(x^2-3x)$

$$= \left(\frac{\int_0^1 (5x+2)(x^2-3x)x^2\,dx}{\int_0^1 (x^2-3x)^2 x^2\,dx}\right)(x^2-3x)$$

$$= \frac{-\frac{49}{15}}{\frac{33}{35}}(x^2-3x)$$

$$\underset{5x+2}{\text{proj}}\,(x^2-3x) = \frac{\langle x^2-3x,\, 5x+2\rangle}{\langle 5x+2,\, 5x+2\rangle}(5x+2)$$

$$= \left(\frac{\int_0^1 (x^2-3x)(5x+2)x^2\,dx}{\int_0^1 (5x+2)^2\,dx}\right)(5x+2)$$

$$= \frac{-\frac{49}{15}}{\frac{34}{3}}(5x+2)$$