1) Consider the following fish classification problem assuming Normal distribution. Find $g(x)$ for the decision boundary

Length of Fish x in (cms)	20	22	24	26	28	30
Seabass ω_1	11	9	8	7	3	2
Salmon ω_2	3	5	6	9	8	9

$$\mu_1 = \frac{11\times20 + 9\times22 + 8\times24 + 7\times26 + 3\times28 + 2\times30}{11+9+8+7+3+2}$$

$$= 23.4$$

$$\mu_2 = \frac{3\times20 + 5\times22 + 6\times24 + 9\times26 + 8\times28 + 9\times30}{3+5+6+9+8+9}$$

$$= 26.05$$

$$\sigma_1^2 = \frac{11\times(20-23.4)^2 + 9\times(22-23.4)^2 + 8\times(24-23.4)^2 + 7\times(26-23.4)^2 + 3\times(28-23.4)^2 + 2\times(30-23.4)^2}{40}$$

$$= 8.64$$

$$\sigma_2^2 = 3\times(20-26.05)^2 + 5\times(22-26.05)^2 + 6\times(24-26.05)^2 + 9\times(26-26.05)^2 + 8\times(28-26.05)^2 + 9\times(30-26.05)^2$$

$$= 9.6975$$

$$g(x) = g_1(x) - g_2(x) = 0$$

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$$-\log\sigma_1 - \frac{(x-\mu_1)^2}{2\sigma_1^2} = -\log\sigma_2 - \frac{(x-\mu_2)^2}{2\sigma_2^2}$$

$$-\log(2.94) - \frac{(x-23.4)^2}{2\times 8.64} = -\log(3.1141) - \frac{(x-26.05)^2}{2\times 9.6975}$$

$$-1.0784 - \frac{(x-23.4)^2}{17.28} = -1.1359 - \frac{(x-26.05)^2}{19.395}$$

$$(x-23.4)^2 = (0.8908)(1.1152 + (x-26.05)^2)$$

$$x^2 - 46.8x + 547.56 = 0.8908(x^2 - 52.1x + 679.7177)$$

$$0.1092x^2 - 0.3893x - 57.9325 = 0$$