1a. We have \( P(Y > 1/2) = \int_{1/2}^{\infty} 7e^{-7y} \, dy = -e^{-7y}\big|_{y=1/2}^{\infty} = e^{-7/2} = 0.0302 \).

1b. We have \( P(0 \leq Y \leq 1/3) = \int_0^{1/3} 7e^{-7y} \, dy = -e^{-7y}\big|_{y=0}^{1/3} = 1 - e^{-7/3} = 0.9030 \).

2a. We have \( \int_0^2 (k)(2 - x)(3 - x) \, dx = \int_0^2 (k)(6 - 5x + x^2) \, dx = (k)(6x - 5x^2/2 + x^3/3)\big|_{x=0}^{2} = (k)(14/3) \). So we need \( k = 3/14 \).

2b. We have \( P(1 \leq X \leq 2) = \int_1^2 (3/14)(2 - x)(3 - x) \, dx = \int_1^2 (3/14)(6 - 5x + x^2) \, dx = (3/14)(6x - 5x^2/2 + x^3/3)\big|_{x=1}^{2} = (3/14)(14/3 - 23/6) = (3/14)(5/6) = 5/28 \).

3a. For \( a > 0 \), we have \( F_Y(a) = P(Y \leq a) = P(0 \leq Y \leq a) = \int_0^a 7e^{-7y} \, dy = -e^{-7y}\big|_{y=0}^{a} = 1 - e^{-7a} \). For \( a \leq 0 \), we have \( F_Y(a) = 0 \).

3b. For \( 0 < a < 2 \), we have \( F_X(a) = \int_0^a (k)(2 - x)(3 - x) \, dx = \int_0^a (3/14)(6 - 5x + x^2) \, dx = (3/14)(6a - 5a^2/2 + a^3/3)\big|_{x=0}^{a} = (3/14)(6a - 5a^2/2 + a^3/3) \). For \( a \leq 0 \), we have \( F_X(a) = 0 \). For \( a \geq 2 \), we have \( F_X(a) = 1 \).

4a. We have \( P(|Y - 1/4| < 1/8) = P(1/8 < Y < 3/8) = \int_{1/8}^{3/8} 7e^{-7y} \, dy = -e^{-7y}\big|_{y=1/8}^{3/8} = e^{-7/8} - e^{-21/8} = 0.3444 \).

4b. We have \( 1/2 = \int_0^a 7e^{-7y} \, dy = -e^{-7y}\big|_{y=0}^{a} = 1 - e^{-7a} \). So we have \( e^{-7a} = 1/2 \), and thus \( -7a = \ln(1/2) \). So we conclude that the median is \( a = (1/7) \ln(2) = 0.0990 \).