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FDP

(a) $f(x) = kx^2 + \frac{1}{30}$; $x \in [0,3]$

$K = \frac{1}{10}$

$$\int_{-\infty}^{\infty} f(x) = 1$$

$$\int_0^3 kx^2 + \frac{1}{30}\, dx$$

$$\int_0^3 kx^2\, dx + \int_0^3 \frac{1}{30}\, dx$$

$$= k \int_0^3 x^2\, dx + \frac{1}{30} \int_0^3 x\, dx$$

$$= k \left[\frac{x^3}{3}\right]_0^3 + \left[\frac{1}{30} x\right]_0^3$$

$$= k \left[\frac{3^3}{3}\right] + \left[\frac{3}{30}\right]$$

$$= k(9) + \frac{1}{10} = 1$$

$$K = \left[\frac{\frac{9}{10}}{\frac{9}{1}}\right] \qquad K = \frac{9}{90}$$

$$\underline{K = \frac{1}{10}} \; //$$

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$P(X < 1) = \frac{1}{15}$

$$\int_0^1 \left(\frac{1}{10}\right) x^2 + \frac{1}{30}\, dx$$

$$\int_0^1 \frac{1}{10} x^2\, dx + \int_0^1 \frac{1}{30}\, dx$$

$$\frac{1}{10}\left[\frac{x^3}{3}\right]_0^1 + \left[\frac{1}{30} x\right]_0^1$$

$$\frac{1}{10} \cdot \frac{1}{3} + \frac{1}{30} = \frac{2}{30} = \frac{1}{15}$$

$P(-0.5 < x < 0.2) = \frac{1}{10}(5.856) + (0.08)$

$$\int_{-0.5}^{0.2} \frac{1}{10} x^2 + \frac{1}{30}\, dx = 0.6656$$

$$\int_{-0.5}^{0.2} \frac{1}{10} x^2 + \int_{-0.5}^{0.2} \frac{1}{30}\, dx$$

$$\frac{1}{10} \cdot \left[\frac{x^3}{3}\right]_{-0.5}^{0.2} + \left[\frac{1}{30} x\right]_{-0.5}^{0.2}$$

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$$⑥\ f(x) = \begin{cases} k + x \ ; & -1 < x < 0 \\ k - x \ ; & 0 \leq x < 1 \end{cases}$$

$$\int_{-1}^{0} k + x \, dx + \int_{0}^{1} k - x \, dx$$

$$k \int_{-1}^{0} x \, dx + k \int_{0}^{1} - x \, dx$$

$$k \left[\frac{x^2}{2} \right]_{-1}^{0} + k \left[\frac{x^2}{2} \right]_{0}^{1} = 1$$

$$-1 + 2k = 1$$

$$2k = 1 + 1$$

$$k = \frac{2}{2}$$

$$k = 1 \ //$$

$$P(0.2 < x < 0.6)$$

$$\int_{0.2}^{0.6} 1 - x \, dx$$

$$\int_{0.2}^{0.6} x \, dx - \int_{0.2}^{0.6} - x \, dx$$

$$[x]_{0.2}^{0.6} - \left[\frac{x^2}{2} \right]_{0.2}^{0.6}$$

$$0.4 - 0.16 = 0.24 \ //$$

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$$P(-0.5 < x < 0.2)$$

$$\int_{-0.5}^{0.2} 1 + x \, dx$$

$$\int_{-0.5}^{0.2} 1 \, dx + \int_{-}^{0.2} x \, dx$$

$$[x]_{-0.5}^{0.2} + \left[\frac{x^2}{2}\right]_{-0.5}^{0.2}$$

$$0.7 + (-0.105)$$

$$= \underline{\underline{0.595}} \,//$$

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(c) $f(x) = \frac{3}{1000}x^2, \; x \in [0, k]$

$\int_0^k \frac{3}{1000}x^2 \, dx = \left[\frac{3}{1000} \cdot \frac{x^3}{3}\right]_0^k$

$= \frac{3}{1000} \cdot \frac{k^3}{3} - \frac{3}{1000} \cdot \frac{0^3}{3}$

$= \frac{\cancel{3}}{1000} \cdot \frac{k^3}{\cancel{3}} \Rightarrow \frac{k^3}{1000} = 1$

$k^3 = 1000$

$k = \sqrt[3]{1000}$

$k = 10$ //

$P(x > 8.5) = 0$

$\int_0^{8.5} \frac{3}{1000}x^2 \, dx$

$\frac{3}{1000}\int_0^{8.5} x^2 \, dx$

$= \frac{3}{1000}\left[\frac{x^3}{3}\right]_0^{8.5}$

$= 0.003 \cdot 204.7$

$= 0.6141$ //

$P(x = 2)$

$= \frac{3}{1000}\left[\frac{x^3}{3}\right]$

$= 0.003 \cdot \frac{8}{3}$

$= 0.008$ //

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(d) $f(x) = 2ke^{-kx}, \quad 0 \leq x \leq 4$

$$\int_0^4 2ke^{-kx}\,dx = 1$$

$$\left[-2e^{-kx}\right]_0^4 = 1$$

$$-2e^{-4k} + 2 = 1$$

$$e^{-4k} = \frac{1}{2}$$

$$-4k = \ln\left(\frac{1}{2}\right)$$

$$k = \frac{-\ln\left(\frac{1}{2}\right)}{4}$$

$$k = \frac{\ln(2)}{4}$$

$$k \approx 0.1733$$

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$p(1 \leq x \leq 2) =$

$$\int_1^2 2(0.1733)e^{-0.1733x}\,dx$$

$$2 \cdot 0.1733 \int_1^2 e^{-0.1733x}\,dx$$

$$0.3466 \cdot \int_{-0.1733}^{-0.3460} -\frac{1}{0.1733}\, e^{\circ}\, dx$$

~ ~

$= 2 \cdot 0.1337$

$= 0.2675$ //