(1) Text 10-18 a, b

(a) $6\,\mathrm{rect}(2t) \longleftrightarrow A\,\mathrm{sinc}(bf)$

$\longleftrightarrow 3\,\mathrm{sinc}\left(\frac{f}{2}\right)$ $\boxed{\begin{array}{l} A = 3 \\ b = 1/2 \end{array}}$

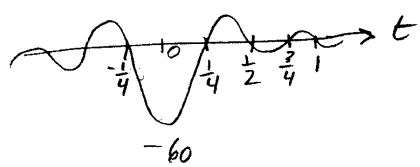
(b) $10\,\mathrm{tri}\left(\frac{t-1}{8}\right) \longleftrightarrow A\,\mathrm{sinc}^2(bf)e^{-j2\pi f}$

$\longleftrightarrow 80\,\mathrm{sinc}^2(8f)e^{-j2\pi f}$ $\boxed{\begin{array}{l} A = 80 \\ b = 8 \\ B = 2 \end{array}}$

(2) Text 10-23 a, c

(a) $x(t) = -60\,\mathrm{sinc}(4t) \longleftrightarrow -15\,\mathrm{rect}\left(\frac{f}{4}\right)$

$\Downarrow$



(c) $\dfrac{2a}{a^2+(2\pi f)^2} \xrightarrow[\text{frequency scale}]{f \to \frac{f}{2\pi}} \dfrac{2a}{a^2+f^2}$

use frequency scale property

$\frac{1}{|a|}x\left(\frac{t}{a}\right) \leftrightarrow X(af)$

here in this problem

$a = \frac{1}{2\pi}$

$\dfrac{2a}{a^2+f^2} \longleftrightarrow \dfrac{1}{\left|\frac{1}{2\pi}\right|}x\left(\dfrac{t}{\frac{1}{2\pi}}\right)$

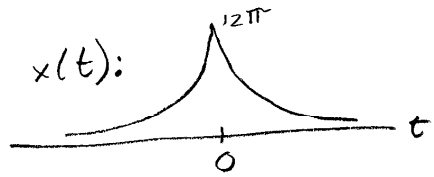
$= 2\pi\, x(2\pi t)$

so since $e^{-a|t|} \longleftrightarrow \dfrac{2a}{a^2+(2\pi f)^2}$

then $2\pi e^{-a|2\pi t|} \longleftrightarrow \dfrac{2a}{a^2+f^2}$

$$6\cdot 2\pi e^{-3|2\pi t|} \longleftrightarrow \frac{18}{3^2+f^2} = 6\cdot\left(\frac{2\cdot 3}{3^2+f^2}\right)$$

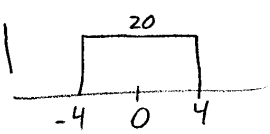
$x(t)$:



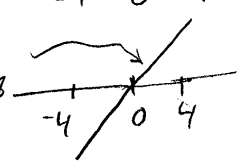
(3) 10-43 b

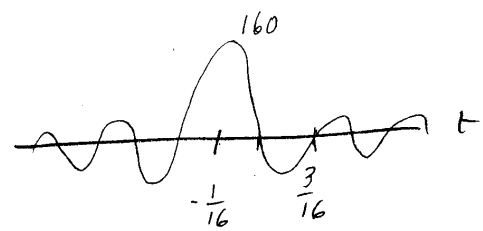
$$X(f) = 20\,\mathrm{rect}\left(\frac{f}{8}\right)e^{j\frac{\pi}{8}f} \longleftrightarrow 160\,\mathrm{sinc}\left(8\left(t+\tfrac{1}{16}\right)\right)$$

$|X(f)|$



slope = π/8





(over)

(4) 10-45 a, b, c

(a) $5\,\mathrm{rect}(2t-1)$

$$5\,\mathrm{rect}(t) \xrightarrow[t\to t-1]{} 5\,\mathrm{rect}(t-1) \xrightarrow[t\to 2t]{} 5\,\mathrm{rect}(2t-1)$$

$$5\,\mathrm{rect}(t) \longleftrightarrow 5\,\mathrm{sinc}(f)$$

$$5\,\mathrm{rect}(t-1) \longleftrightarrow 5\,\mathrm{sinc}(f)\,e^{-j2\pi f}$$

$$5\,\mathrm{rect}(2t-1) \longleftrightarrow 5\,\frac{1}{|2|}\,\mathrm{sinc}\left(\frac{f}{2}\right)e^{-j2\pi\left(\frac{f}{2}\right)} = \boxed{2.5\,\mathrm{sinc}\left(\tfrac{f}{2}\right)e^{-j\pi f}}$$

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(b) $5\,\mathrm{rect}\left(\frac{t}{2}-1\right)$

$$5\,\mathrm{rect}(t) \xrightarrow[t\to t-1]{} 5\,\mathrm{rect}(t-1) \xrightarrow[t\to t/2]{} 5\,\mathrm{rect}\left(\tfrac{t}{2}-1\right)$$

$$5\,\mathrm{rect}(t) \longleftrightarrow 5\,\mathrm{sinc}(f)$$

$$5\,\mathrm{rect}(t-1) \longleftrightarrow 5\,\mathrm{sinc}(f)\,e^{-j2\pi f}$$

$$5\,\mathrm{rect}\left(\tfrac{t}{2}-1\right) \longleftrightarrow \frac{5}{\left|\frac{1}{2}\right|}\,\mathrm{sinc}(2f)\,e^{-j2\pi(2f)} = \boxed{10\,\mathrm{sinc}(2f)\,e^{-j4\pi f}}$$

#1

(c) $5\,\mathrm{rect}(2(t-1))$

$$5\,\mathrm{rect}(t) \xrightarrow[t\to 2t]{} 5\,\mathrm{rect}(2t) \xrightarrow[t\to t-1]{} 5\,\mathrm{rect}(2(t-1))$$

$$5\,\mathrm{rect}(t) \longleftrightarrow 5\,\mathrm{sinc}(f)$$

$$5\,\mathrm{rect}(2t) \longleftrightarrow \frac{5}{|2|}\,\mathrm{sinc}(f/2) = 2.5\,\mathrm{sinc}(f/2)$$

$$5\,\mathrm{rect}(2(t-1)) \longleftrightarrow \boxed{2.5\,\mathrm{sinc}(f/2)\,e^{-j2\pi f}}$$

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