

$$5\text{rect}(3t - 6) \xleftrightarrow{\mathcal{F}} ?$$

$$\text{rect}(t) \xleftrightarrow{\mathcal{F}} \text{sinc}(f)$$

$$\text{Linearity: } 5\text{rect}(t) \xleftrightarrow{\mathcal{F}} 5\text{sinc}(f)$$

$$\text{Time Shifting: } 5\text{rect}(t - 6) \xleftrightarrow{\mathcal{F}} 5\text{sinc}(f)e^{-j12\pi f}$$

$$\text{Time Scaling: } 5\text{rect}(3t - 6) \xleftrightarrow{\mathcal{F}} (1/3) \times 5\text{sinc}(f/3)e^{-j12\pi f/3}$$

$$5\text{rect}(3t - 6) \xleftrightarrow{\mathcal{F}} (5/3)\text{sinc}(f/3)e^{-j4\pi f}$$

$$5\text{rect}\big(3(t-2)\big)\xleftrightarrow{\mathcal{F}}?$$

$$\text{rect}(t)\xleftrightarrow{\mathcal{F}}\text{sinc}(f)$$

$$\text{Linearity: } 5\text{rect}(t)\xleftrightarrow{\mathcal{F}}5\text{sinc}(f)$$

$$\text{Time Scaling: } 5\text{rect}(3t)\xleftrightarrow{\mathcal{F}}(5/3)\text{sinc}(f/3)$$

$$\text{Time Scaling: } 5\text{rect}\big(3(t-2)\big)\xleftrightarrow{\mathcal{F}}(5/3)\text{sinc}(f/3)e^{-j4\pi f}$$

From the previous slide

$$5\text{rect}(3t-6)\xleftrightarrow{\mathcal{F}}(5/3)\text{sinc}(f/3)e^{-j4\pi f}$$

$$5\text{rect}\big(3(t-6)\big)\xleftrightarrow{\mathcal{F}}?$$

$$\text{rect}(t)\xleftrightarrow{\mathcal{F}}\text{sinc}(f)$$

$$\text{Linearity: } 5\text{rect}(t)\xleftrightarrow{\mathcal{F}}5\text{sinc}(f)$$

$$\text{Time Scaling: } 5\text{rect}(3t)\xleftrightarrow{\mathcal{F}}(5/3)\text{sinc}(f/3)$$

$$\text{Time Shifting: } 5\text{rect}\big(3(t-6)\big)\xleftrightarrow{\mathcal{F}}(5/3)\text{sinc}(f/3)e^{-j12\pi f}$$

$$10\cos(200\pi t) \xleftrightarrow{\mathcal{F}} ?$$

$$\cos(2\pi f_0 t) \xleftrightarrow{\mathcal{F}} (1/2) [\delta(f - f_0) + \delta(f + f_0)]$$

Linearity:

$$10\cos(2\pi f_0 t) \xleftrightarrow{\mathcal{F}} 5 [\delta(f - f_0) + \delta(f + f_0)]$$

$$f_0 = 100 \Rightarrow$$

$$10\cos(200\pi t) \xleftrightarrow{\mathcal{F}} 5 [\delta(f - 100) + \delta(f + 100)]$$

OR

$$10\cos(2\pi t) \xleftrightarrow{\mathcal{F}} 5 [\delta(f - 1) + \delta(f + 1)]$$

Time Scaling:

$$10\cos(200\pi t) \xleftrightarrow{\mathcal{F}} (5/100) [\delta(f/100 - 1) + \delta(f/100 + 1)]$$

$$10\cos(200\pi t) \xleftrightarrow{\mathcal{F}} (1/20) [\delta((1/100)f - 100) + \delta((1/100)f + 100)]$$

Impulse Scaling Property: $10\cos(200\pi t) \xleftrightarrow{\mathcal{F}} (100/20) [\delta(f - 100) + \delta(f + 100)]$

$$4 \operatorname{sinc}(t / 20) * 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} ?$$

$$\operatorname{sinc}(t) \xleftrightarrow{\mathcal{F}} \operatorname{rect}(f) \quad , \quad \operatorname{tri}(t) \xleftrightarrow{\mathcal{F}} \operatorname{sinc}^2(f)$$

$$4 \operatorname{sinc}(t) \xleftrightarrow{\mathcal{F}} 4 \operatorname{rect}(f) \quad , \quad 3 \operatorname{tri}(t) \xleftrightarrow{\mathcal{F}} 3 \operatorname{sinc}^2(f)$$

$$4 \operatorname{sinc}(t / 20) \xleftrightarrow{\mathcal{F}} 80 \operatorname{rect}(80f) \quad , \quad 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} (3/2) \operatorname{sinc}^2(f/2)$$

$$x(t) * y(t) \xleftrightarrow{\mathcal{F}} X(f) Y(f)$$

$$4 \operatorname{sinc}(t / 20) * 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} 80 \operatorname{rect}(80f) (3/2) \operatorname{sinc}^2(f/2)$$

$$4 \operatorname{sinc}(t / 20) * 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} 120 \operatorname{rect}(80f) \operatorname{sinc}^2(f/2)$$

$$4 \operatorname{sinc}(t / 20) * 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} 120 \operatorname{rect}(80\omega / 2\pi) \operatorname{sinc}^2((\omega / 2\pi) / 2)$$

$$4 \operatorname{sinc}(t / 20) * 3 \operatorname{tri}(2t) \xleftrightarrow{\mathcal{F}} 120 \operatorname{rect}((40 / \pi)\omega) \operatorname{sinc}^2(\omega / 4\pi)$$

$$? \xleftrightarrow{\mathcal{F}} j15 \left[\delta(f+10) - \delta(f-10) \right] * 8 \text{sinc}(6f)$$

$$\sin(2\pi f_0 t) \xleftrightarrow{\mathcal{F}} (j/2) \left[\delta(f+f_0) - \delta(f-f_0) \right]$$

$$\text{Linearity, } f_0=10: 30 \sin(20\pi t) \xleftrightarrow{\mathcal{F}} j15 \left[\delta(f+10) - \delta(f-10) \right]$$

$$\text{rect}(t) \xleftrightarrow{\mathcal{F}} \text{sinc}(f)$$

$$8 \text{rect}(t) \xleftrightarrow{\mathcal{F}} 8 \text{sinc}(f)$$

$$(8/6) \text{rect}(t/6) \xleftrightarrow{\mathcal{F}} 8 \text{sinc}(6f)$$

$$(4/3) \text{rect}(t/6) \xleftrightarrow{\mathcal{F}} 8 \text{sinc}(6f)$$

$$x(t)y(t) \xleftrightarrow{\mathcal{F}} X(f) * Y(f)$$

$$30 \sin(20\pi t) (4/3) \text{rect}(t/6) \xleftrightarrow{\mathcal{F}} j15 \left[\delta(f+10) - \delta(f-10) \right] * 8 \text{sinc}(6f)$$

$$40 \sin(20\pi t) \text{rect}(t/6) \xleftrightarrow{\mathcal{F}} j15 \left[\delta(f+10) - \delta(f-10) \right] * 8 \text{sinc}(6f)$$