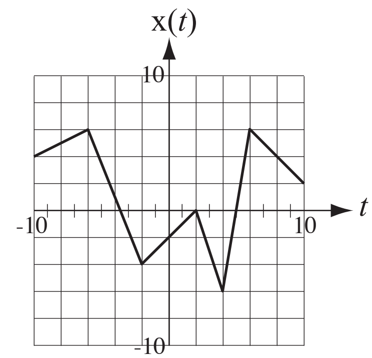
Solution of EECS 315 Test 1 F13

1. A continuous-time signal $\mathrm{x}(t)$ is defined by the graph below. Let $\mathrm{y}(t) = -4\,\mathrm{x}(t+3)$ and let $\mathrm{z}(t) = 8\,\mathrm{x}(t/4)$ Find the numerical values of



(a) $\mathrm{y}(3) = -4\,\mathrm{x}(3+3) = -4\,\mathrm{x}(6) = -4\times 6 = -24$

(b) $\mathrm{z}(-4) = 8\,\mathrm{x}(-4/4) = 8\,\mathrm{x}(-1) = 8\times(-3) = -24$

(c) $\frac{d}{dt}(\mathrm{z}(t))\Big|_{t=10} = \frac{d}{dt}(8\,\mathrm{x}(t/4))\Big|_{t=10} = 8\frac{d}{dt}(\mathrm{x}(t/4))\Big|_{t=10} = \frac{8\frac{d}{dt}(\mathrm{x}(t))\Big|_{t=10/4}}{4} = \frac{8\times(-3)}{4} = -6$

(The time scaling $t \to t/4$ makes all the derivatives a factor of 4 smaller.)

2. Find the numerical values of

(a) $\mathrm{ramp}(-3(-2))\times\mathrm{rect}(-2/10) = \mathrm{ramp}(6)\mathrm{rect}(-1/5) = 6\times 1 = 6$

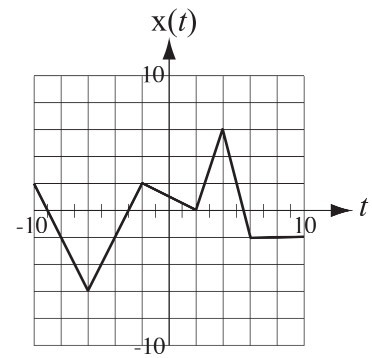
(b) $\int_{-\infty}^{\infty} 3\delta(t-4)\cos(\pi t/10)\,dt = 3\cos(4\pi/10) = 0.9271$

(c) $\frac{d}{dt}(2\,\mathrm{sgn}(t/5)\mathrm{ramp}(t-8)) = 2\,\mathrm{sgn}(t/5)\mathrm{u}(t-8) + 2\,\mathrm{ramp}(t-8)\times 2\delta(t)$

$$\left[\frac{d}{dt}(2\,\mathrm{sgn}(t/5)\mathrm{ramp}(t-8))\right]_{t=13} = 2\underbrace{\mathrm{sgn}(13/5)}_{1}\underbrace{\mathrm{u}(5)}_{1} + 2\underbrace{\mathrm{ramp}(5)}_{5}\times 2\underbrace{\delta(13)}_{0} = 2$$

Solution of EECS 315 Test 1 F13

1. A continuous-time signal $\mathrm{x}(t)$ is defined by the graph below. Let $\mathrm{y}(t) = -4\,\mathrm{x}(t-2)$ and let $\mathrm{z}(t) = 5\,\mathrm{x}(t/6)$ Find the numerical values of



(a) $\mathrm{y}(3) = -4\,\mathrm{x}(3-2) = -4\,\mathrm{x}(1) = -4 \times 1/2 = -2$

(b) $\mathrm{z}(t) = 5\,\mathrm{x}(-6/6) = 5 \times \mathrm{x}(-1) = 5 \times 3/2 = 7.5$

(c) $$\frac{d}{dt}(\mathrm{z}(t))\Big|_{t=10} = \frac{d}{dt}(5\,\mathrm{x}(t/6))\Big|_{t=10} = 5\frac{d}{dt}(\mathrm{x}(t/6))\Big|_{t=10} = \frac{5\frac{d}{dt}(\mathrm{x}(t))\Big|_{t=10/6}}{6} = \frac{5 \times (-1/2)}{6} = -5/12$$

(The time scaling $t \to t/6$ makes all the derivatives a factor of 6 smaller.)

2. Find the numerical values of

(a) $\mathrm{ramp}(-8(-2)) \times \mathrm{rect}(-2/10) = \mathrm{ramp}(16)\mathrm{rect}(-1/5) = 16 \times 1 = 16$

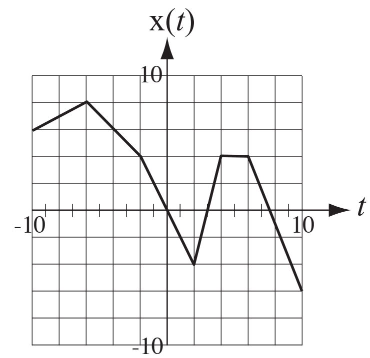
(b) $$\int_{-\infty}^{\infty} 3\delta(t-4)\cos(\pi t/20)\,dt = 3\cos(4\pi/20) = 2.4271$$

(c) $$\frac{d}{dt}(7\,\mathrm{sgn}(t/3)\mathrm{ramp}(t-2)) = 7\,\mathrm{sgn}(t/3)\mathrm{u}(t-2) + 7\,\mathrm{ramp}(t-2) \times 2\delta(t)$$

$$\left[\frac{d}{dt}(7\,\mathrm{sgn}(t/3)\mathrm{ramp}(t-2))\right]_{t=13} = 7\underbrace{\mathrm{sgn}(13/3)}_{1}\underbrace{\mathrm{u}(11)}_{1} + 2\underbrace{\mathrm{ramp}(11)}_{11} \times 2\underbrace{\delta(13)}_{0} = 7$$

Solution of EECS 315 Test 1 F13

1. A continuous-time signal $\mathrm{x}(t)$ is defined by the graph below. Let $\mathrm{y}(t)=11\,\mathrm{x}(t+1)$ and let $\mathrm{z}(t)=-9\,\mathrm{x}(t/2)$ Find the numerical values of



(a) $\mathrm{y}(3)=11\,\mathrm{x}(3+1)=11\,\mathrm{x}(4)=11\times 4=44$

(b) $\mathrm{z}(-4)=-9\,\mathrm{x}(-4/2)=-9\,\mathrm{x}(-2)=-9\times 4=-36$

(c) $$\frac{d}{dt}(\mathrm{z}(t))\Big|_{t=10}=\frac{d}{dt}(-9\,\mathrm{x}(t/2))\Big|_{t=10}=-9\frac{d}{dt}(\mathrm{x}(t/2))\Big|_{t=10}=\frac{-9\frac{d}{dt}(\mathrm{x}(t))\Big|_{t=10/2}}{2}=\frac{8\times(0)}{4}=0$$

(The time scaling $t \to t/2$ makes all the derivatives a factor of 2 smaller.)

2. Find the numerical values of

(a) $\mathrm{ramp}(7\times 3)\times \mathrm{rect}(-3/15)=\mathrm{ramp}(21)\mathrm{rect}(-3/15)=21\times 1=21$

(b) $$\int_{-\infty}^{\infty} 12\delta(t-3)\cos(\pi t/10)\,dt=12\cos(3\pi/10)=7.0534$$

(c) $$\frac{d}{dt}(-6\,\mathrm{sgn}(t/7)\mathrm{ramp}(t-5))=-6\,\mathrm{sgn}(t/7)\mathrm{u}(t-5)-6\,\mathrm{ramp}(t-5)\times 2\delta(t)$$

$$\left[\frac{d}{dt}(-6\,\mathrm{sgn}(t/7)\mathrm{ramp}(t-5))\right]_{t=11}=-6\underbrace{\mathrm{sgn}(11/7)}_{1}\underbrace{\mathrm{u}(6)}_{1}-6\underbrace{\mathrm{ramp}(6)}_{5}\underbrace{\delta(11)}_{0}=-6$$