Introduction to Mathematica

#CA1

#Q5

Signals & Systems

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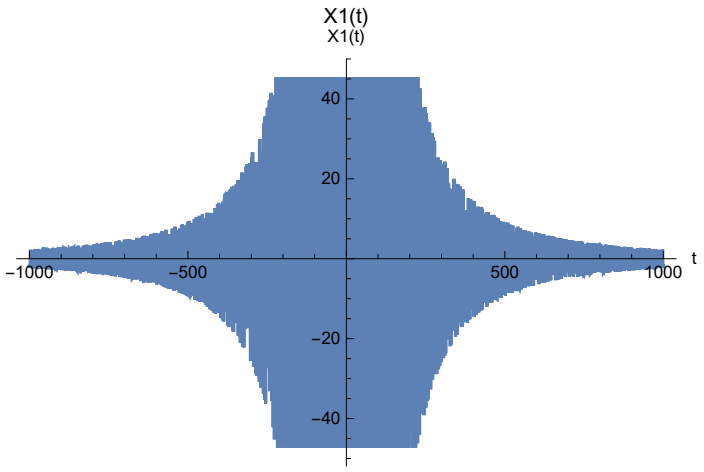
Part A

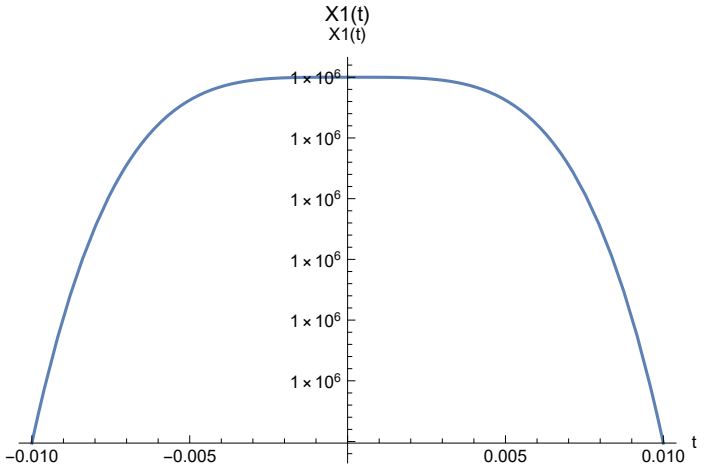
In[•]:=
```
X1[t_, eps_] := (1 / eps) * (Sin[Pi * ((t / E) ^ 2)] / (Pi * ((t / E) ^ 2)))
∫_-Infinity^Infinity (Limit[X1[t, eps], eps → 10^(-6)]) dt
Plot[X1[t], {t, -1000, 1000}, PlotLabel → "X1(t)", AxesLabel → {"t", "X1(t)"}]
Plot[X1[t], {t, -0.01, 0.01}, PlotLabel → "X1(t)", AxesLabel → {"t", "X1(t)"}]
```

Out[•]=
$$1\,000\,000\,\sqrt{2}\ e$$

Out[•]=



Out[•]=

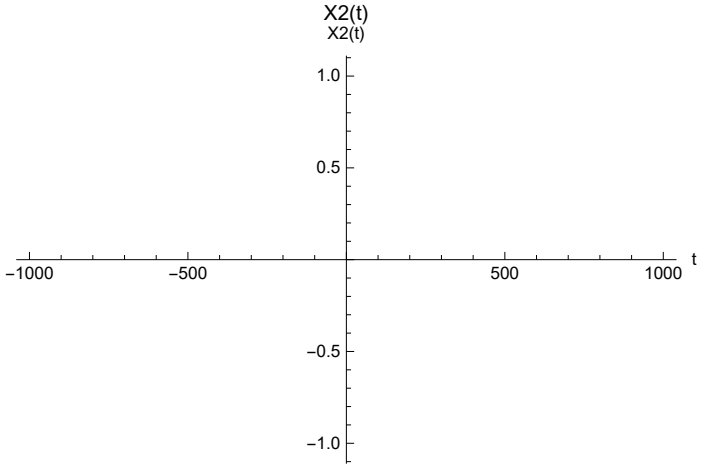


In[11]:=
$$X2[t\_, eps\_] := \begin{cases} \frac{\left(1-\frac{Abs[t]}{eps}\right)}{eps} & Abs[t] \le eps \\ 0 & Abs[t] > eps \end{cases}$$

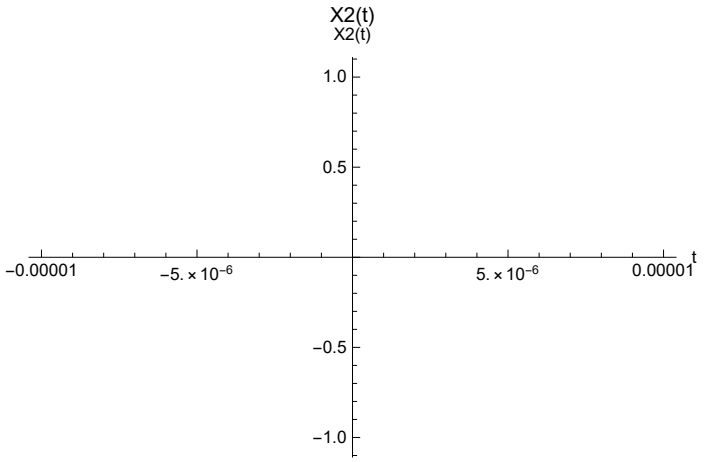
```
Integrate[(Limit[X2[t, eps], eps → 10^(-6)]), {t, -Infinity, Infinity}]
Plot[X2[t], {t, -1000, 1000}, PlotLabel → "X2(t)", AxesLabel → {"t", "X2(t)"}]
Plot[X2[t], {t, -0.00001, 0.00001}, PlotLabel → "X2(t)", AxesLabel → {"t", "X2(t)"}]
```

Out[12]= 1

Out[13]=



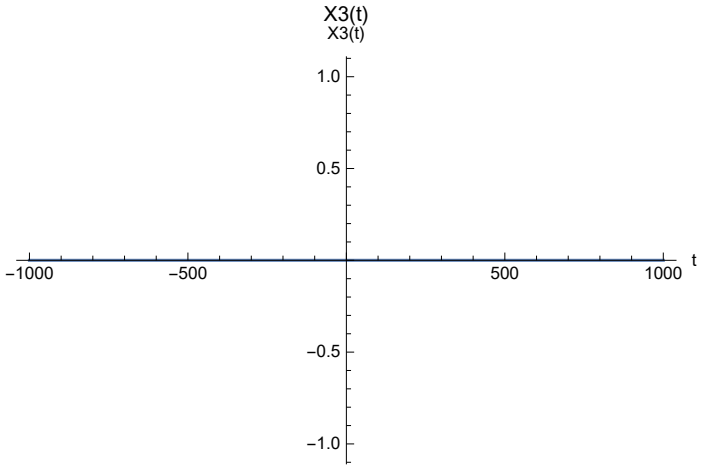
Out[14]=



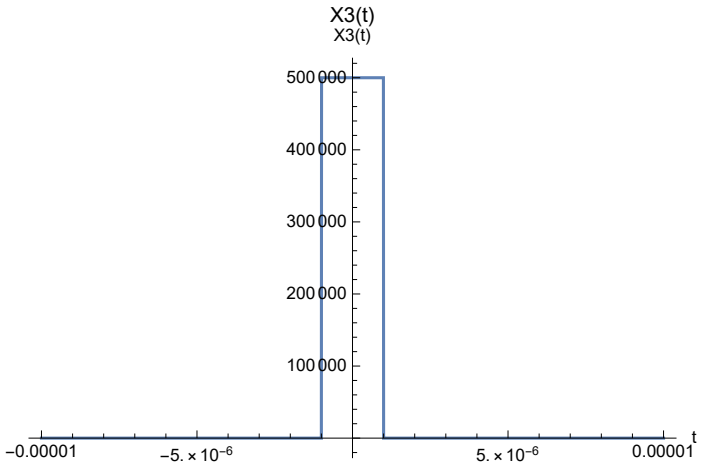
In[ ]:=
```
X3[t_, eps_] :=
 (1 / (2 * eps)) * (UnitStep[(t / (2 * eps)) + 1 / 2] - UnitStep[(t / (2 * eps)) - 1 / 2])
∫_-Infinity^Infinity (Limit[X3[t, eps], eps → 10^(-6)]) dt
Plot[X3[t], {t, -1000, 1000}, PlotLabel → "X3(t)", AxesLabel → {"t", "X3(t)"}]
Plot[X3[t], {t, -0.00001, 0.00001}, PlotLabel → "X3(t)", AxesLabel → {"t", "X3(t)"}]
```

Out[ ]= 1

Out[ ]=



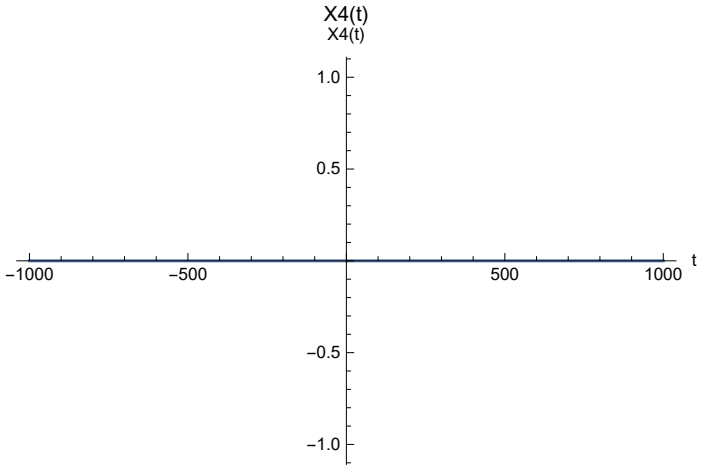
Out[ ]=



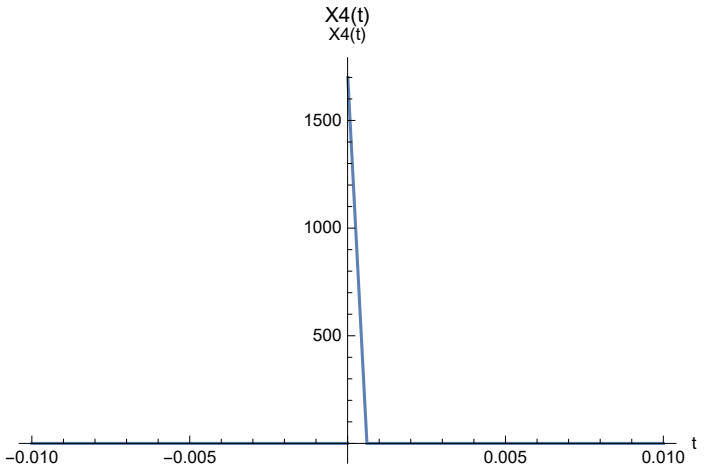
In[ ]:=
```
X4[t_, eps_] := (1 / eps) * (Exp[-(t / eps)]) * UnitStep[t]

∫_-Infinity^Infinity (Limit[X4[t, eps], eps → 10^(-6)]) dt
Plot[X4[t], {t, -1000, 1000}, PlotLabel → "X4(t)", AxesLabel → {"t", "X4(t)"}]
Plot[X4[t], {t, -0.01, 0.01}, PlotLabel → "X4(t)", AxesLabel → {"t", "X4(t)"}]
```

Out[ ]= 1

Out[ ]=



Out[ ]=

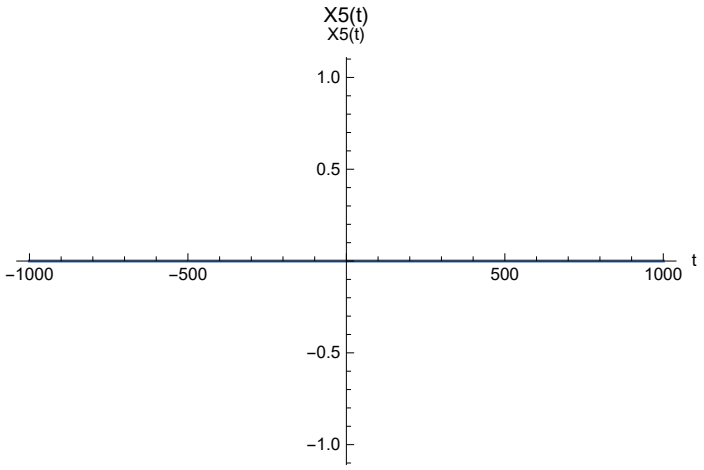


In[ ]:=
```
X5[t_, eps_] := Exp[-t^2/(2*(eps)^2)] / Sqrt[2 * Pi * (eps)^2]

Integrate[(Limit[X5[t, eps], eps → 10^(-6)]), {t, -Infinity, Infinity}]

Plot[X5[t], {t, -1000, 1000}, PlotLabel → "X5(t)", AxesLabel → {"t", "X5(t)"}]

Plot[X5[t], {t, -0.001, 0.001}, PlotLabel → "X5(t)", AxesLabel → {"t", "X5(t)"}]
```

Out[ ]= 1

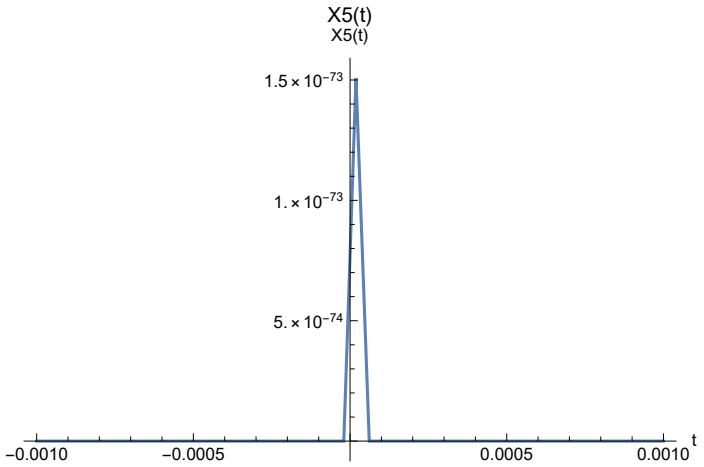
General: Exp[−4.99959 × 10^17] is too small to represent as a normalized machine number; precision may be lost.

Out[ ]=



General: Exp[−499959.] is too small to represent as a normalized machine number; precision may be lost.

Out[ ]=



Part B

In[ ]:=
```
Export["X1.gif", Animate[X1[t, eps], {eps, 10, 0.1}]]
```

Out[ ]= X1.gif

In[ ]:=
```
Export["X2.gif", Animate[X2[t, eps], {eps, 10, 0.1}]]
```

Out[ ]= X2.gif

In[ ]:=
```
Export["X3.gif", Animate[X3[t, eps], {eps, 10, 0.1}]]
```

Out[ ]= X3.gif

In[•]:=
```
Export["X4.gif", Animate[X4[t, eps], {eps, 10, 0.1}]]
```

Out[•]= X4.gif

In[•]:=
```
Export["X5.gif", Animate[X5[t, eps], {eps, 10, 0.1}]]
```

Out[•]= X5.gif