1. (10 scores) The signal $x(t)$ is shown in Fig.1, please sketch the waveform $y(t) = x(-2t + 6)$.

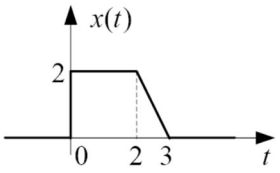

Fig.1

2. (12 scores) A system is described by $y(t)=\cos\left(3t-\frac{\pi}{2}\right)x(t)$,please judge the properties of the system and give your reasons.

（1）memory?; （2）linear?; （4）time-invariant?; （3）causal?

3. (10 scores)The differential equation of a system is

$$\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+6y(t)=x(t)$$

Please calculate:

（1）the impulse response $h(t)$;

（2）if $x(t)=e^{-t}u(t)$,calculate the zero-state response $y(t)$.

4. (12 scores) Please calculate the following convolutions:

（1） $x(t)$ and $h(t)$ are shown in Fig.2.a and Fig.2.b,please calculate $y(t)=x(t)*h(t)$.

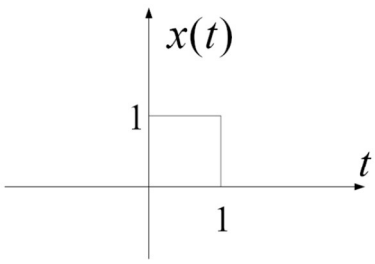

Fig.2.a

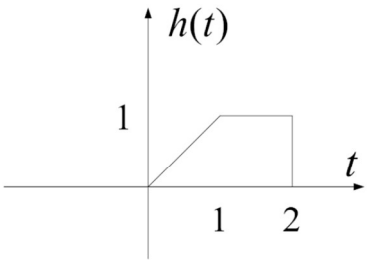

Fig.2.b

（2） $x[n]=\delta[n+1]+2\delta[n]+\delta[n-1]$， $v[n]=\delta[n-1]+2\delta[n-2]$，

$y[n]=x[n]*v[n]=?$ (convolution sum)

（3） $x[n]=2\delta[n]+\delta[n-1]-\delta[n-2]+3\delta[n-3]$， $v[n]=\delta[n]+2\delta[n-1]$

$y[n]=x[n]$ ④ $v[n]=?$ or expressed as $y[n]=x[n]$ ⊛ $v[n]=?$

N=4,4-point circular convolution

5. (10 scores) A periodic signal is shown in Fig.3, Please calculate:

（1） trigonometric Fourier series;

（2） exponential Fourier series.

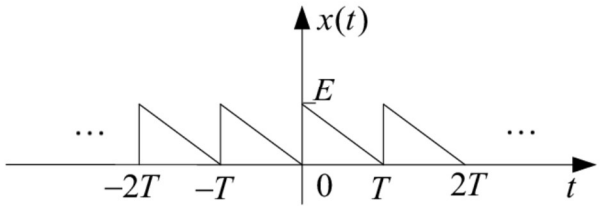

Fig.3

6. (8 scores) Calculate Laplace transform for the following signals:

（1） $x(t) = te^{-2t}u(t)$

（2） $x(t) = (t-1)[u(t-1) - u(t-2)]$

7. (12 scores) A circuit is shown in Fig.4. Assuming that the circuit is in steady state at $t<0$,and the switch is opened at $t=0$,Please calculate the current $i(t)$, $t\geq 0$.

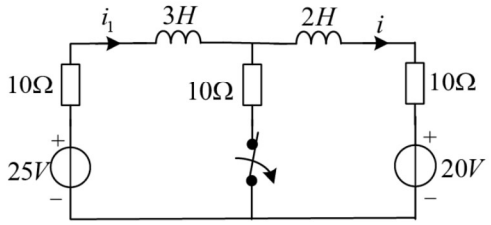

Fig.4

8. (10 scores) A continuous time signal is $x(t) = \cos(2\pi ft)$,if $f = 1\text{Hz}$,the sampling

interval $T_S = \frac{1}{4}$ seconds, the sampled signal is $x[n]$,please calculate:

(1) the discrete values of the 4 points;

(2) four-point DFT of $x[n]$;

(3)four-point DTFT of $x[n]$.

9. (10 scores) A causal linear time invariant system is described by following difference equation

$$y[n]-\frac{3}{4}y[n-1]+\frac{1}{2}y[n-2]=x[n]$$

(1) calculate the transfer function (or system function) $H(z)$;

(2) calculate the unit pulse response $h[n]$;

(3) calculate the unit step response $y[n]$;

(4) judge the stability of the system.