WeBWorK assignment number Chpt7_Review_Practice_Only is due : 05/06/2009 at 11:58pm MST.

The primary purpose of WeBWorK is to let you know that you are getting the correct answer or to alert you if you are making some kind of mistake. Usually you can attempt a problem as many times as you want before the due date. However, if you are having trouble figuring out your error, you should consult the book, or ask a fellow student, one of the TA's or your professor for help. Don't spend a lot of time guessing – it's not very efficient or effective.

Give 4 or 5 significant digits for (floating point) numerical answers. For most problems when entering numerical answers, you can if you wish enter elementary expressions such as $2 \wedge 3$ instead of 8, $sin(3*pi/2)$instead of -1, $e \wedge (ln(2))$ instead of 2, $(2+tan(3))*(4-sin(5)) \wedge 6-7/8$ instead of 27620.3413, etc. Here's the **list of the functions** which WeBWorK understands.

You can use the Feedback button on each problem page to send e-mail to the professors.

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1. (1 pt) Find the inverse Laplace transform of

$$F(s) = \frac{e^{-6s}}{s^2+2s-15}$$

$f(t) =$ ____________. (Use step(t-c) for $u_c(t)$.)

Correct Answers:

- `step(t-6)*(-0.125*exp(-5*(t-6))+0.125*exp( + 3*(t-6)))`

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2. (1 pt) Find the inverse Laplace transform of

$$F(s) = \frac{5e^{-6s}}{s^2+25}$$

$f(t) =$ ____________. (Use step(t-c) for $u_c(t)$.)

Correct Answers:

- `step(t-6)*5/5*sin(5*(t-6))`

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3. (1 pt) Find the Laplace transform of

$$f(t) = \begin{cases} 0, & t < 4 \\ (t-4)^5, & t \geq 4 \end{cases}$$

$F(s) =$ ____________.

Correct Answers:

- `exp(-4*s)*120/s^6`

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4. (1 pt) Take the Laplace transform of the following initial value problem and solve for $Y(s) = \mathcal{L}\{y(t)\}$:

$$y'' - 2y' - 24y = \begin{cases} 1, & 0 \leq t < 1 \\ 0, & 1 \leq t \end{cases} \qquad y(0) = 0,\ y'(0) = 0$$

$Y(s) =$ ____________.

Now find the inverse transform to find $y(t) =$ ____________. (Use step(t-c) for $u_c(t)$.) Note:

$$\frac{1}{s(s-6)(s+4)} = \frac{-\frac{1}{24}}{s} + \frac{\frac{1}{40}}{s+4} + \frac{\frac{1}{60}}{s-6}$$

Correct Answers:

- `(1-exp(-s))/(s*(s^2-2*s-24))`
- `-0.0416666666666667+ 0.025*exp(-4*t)+0.0166666666666667*exp( + 6*t)-step(t-1)*(-0.0416666666666667+0.025*exp(-4*(t-1))+0.0166666666666667*exp( + 6*(t-1)))`

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5. (1 pt) Take the Laplace transform of the following initial value and solve for $Y(s) = \mathcal{L}\{y(t)\}$:

$$y'' + 9y = \begin{cases} \sin(\pi t), & 0 \leq t < 1 \\ 0, & 1 \leq t \end{cases} \qquad y(0) = 0,\ y'(0) = 0$$

$Y(s) =$ ____________. Hint: write the right hand side in terms of the Heaviside function.

Now find the inverse transform to find $y(t) =$ ____________. (Use step(t-c) for $u_c(t)$.) Note:

$$\frac{\pi}{(s^2+\pi^2)(s^2+9)} = \frac{\pi}{\pi^2-9}\left(\frac{1}{s^2+9} - \frac{1}{s^2+\pi^2}\right)$$

Correct Answers:

- `pi*(1+exp(-s))/((s^2+pi^2)*(s^2+9))`
- `3.61267*(sin(3*t)/3-sin(pi*t)/pi + step(t-1)*(sin(3*(t-1))`

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6. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' - 4y' - 21y = \delta(t-3) \qquad y(0) = 0,\ y'(0) = 0$$

Use step(t-c) for $u_c(t)$.

$y(t) =$ ____________.

Correct Answers:

- `step(t-3)*(0.1*exp( + 7*(t-3)) - 0.1*exp(-3*(t-3)))`

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7. (1 pt) Find the Laplace transform of the following functions:

1. $f(t) = 9\sqrt{t} - 9t$

$F(s) =$ ____________.

2. $f(t) = 7t^{3/2} - e^{-10t}$

$F(s) =$ ____________.

3. $f(t) = \sin(3t) + \cos(3t)$

$F(s) =$ ____________.

Correct Answers:

- `9*sqrt(3.14159265358979)/(2*s^(3/2))+-9/s^2`
- `3*7*sqrt(3.14159265358979)/(4*s^(5/2))-1/(s+10)`
- `(3+s)/(s^2+3^2)`

8. (1 pt) Find the Laplace transform of the following functions:

1. $f(t) = \sin(7t)\cos(7t)$

$F(s) =$ ______________.

2. $f(t) = \cos^2(3t)$

$F(s) =$ ______________.

3. $f(t) = (3-8t)^2$

$F(s) =$ ______________.

Correct Answers:

- `7/(s^2+4*7**2)`
- `(2*3**2+s^2)/((s^2+4*3**2)*s)`
- `3**2/s+2*3*-8/s**2+2*(64)/s**3`

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9. (1 pt) Find the Laplace transform of

$$f(t) = -3u_3(t) - 5u_5(t) - 5u_7(t)$$

$F(s) =$ ______________.

Correct Answers:

- `-3*exp(-3*s)/s - 5*exp(-5*s)/s - 5*exp(-7*s)/s`

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10. (1 pt) Find the inverse Laplace transform of

$$F(s) = \frac{6e^{-3s} - 4e^{-5s} + 3e^{-6s} + 4e^{-7s}}{s}$$

$f(t) =$ ______________. (Use step(t-c) for $u_c(t)$.)

Correct Answers:

- `6*step(t-3) - 4*step(t-5)+3*step(t-6)+4*step(t-7)`

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11. (1 pt) Find the Laplace transform of

$$f(t) = -1u_4(t) - 5u_6(t) - 3u_7(t)$$

$F(s) =$ ______________.

Correct Answers:

- `-1*exp(-4*s)/s - 5*exp(-6*s)/s - 3*exp(-7*s)/s`

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12. (1 pt) Find the Laplace transform of

$$f(t) = 5u_2(t) - 4u_3(t) - 6u_4(t)$$

$F(s) =$ ______________.

Correct Answers:

- `5*exp(-2*s)/s - 4*exp(-3*s)/s - 6*exp(-4*s)/s`

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13. (1 pt) Consider the function $f(t) = \begin{cases} 3, & 0 \le t < 3 \\ 5, & 3 \le t < 6 \\ 3, & t \ge 6 \end{cases}$;

1. Write the function in terms of unit step function

$f(t) =$ ______________. (Use step(t-c) for $u_c(t)$.)

2. Find the Laplace transform of $f(t)$

$F(s) =$ ______________.

Correct Answers:

- `3+2*step(t-3) - 2*step(t-6)`
- `3/s+2*exp(-3*s)/s - 2*exp(-6*s)/s`

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14. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' + 9y = \cos(7t) \qquad y(0) = 0,\ y'(0) = 0$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation and solving for Y:

$Y(s) =$ ______________

Find the partial fraction decomposition of $Y(s)$ and its inverse Laplace transform to find the solution of the DE:

$y(t) =$ ______________.

Correct Answers:

- `s/((s^2+9)*(s^2+7**2))`
- `1/-40*(cos(7*t)-cos(3*t))`

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15. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' - 12y' + 52y = 0 \qquad y(0) = 0,\ y'(0) = 9$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation

______________ $= 0$

Now solve for $Y(s) =$ ______________

By completing the square in the denominator and inverting the transform, find

$y(t) =$ ______________.

Correct Answers:

- `s^2*Y-9-12*s*Y+52*Y`
- `9/(s^2-12*s+52)`
- `(9/4)*exp(6*t)*sin(4*t)`

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16. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' - 10y' + 26y = 0 \qquad y(0) = 1,\ y'(0) = 5$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation

______________ $= 0$

Now solve for $Y(s) =$ ______________

By completing the square in the denominator and inverting the transform, find $y(t) =$ ______________.

Correct Answers:

- `s^2*Y-1*s-5-10*(s*Y-1)+26*Y`
- `(s-5)/(s^2-10*s+26)`
- `exp(5*t)*cos(1*t)`

17. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$x^{(4)}+46x''+529x=0 \qquad x(0)=x'(0)=x''(0)=0,\ x^{(3)}(0)=1$$

First, using $X(s)$ for the Laplace transform of $x(t)$, i.e., $X(s)=\mathcal{L}\{x(t)\}$,
find the expression you get by taking the Laplace transform of the differential equation and solving for X(s).
$X(s) =$ ______________________
Now, by inverting the transform , find the solution
$x(t) =$ ______________________.
Correct Answers:

- 1/(s**2+23)**2
- (sin(4.79583152331272*t)-4.79583152331272*t*cos(4.79583152331272*t))/(2*4.79583152331272**3)

18. (1 pt) Find the inverse Laplace Transform of

$$\frac{6s-81}{s^2-12s+55}$$

$y(t) =$ ______________________.
Correct Answers:

- 6*exp(6*t)*cos(sqrt(19)*t)+ ((-9-6*6)/sqrt(19))*exp(6*t)*sin(sqrt(19)*t)

19. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$x''-9x=2t \qquad x(0)=x'(0)=0$$

First, using $X(s)$ for the Laplace transform of $x(t)$, i.e., $X(s)=\mathcal{L}\{x(t)\}$,
find the expression you get by taking the Laplace transform of the differential equation and solving for X(s).
$X(s) =$ ______________________
Now, by inverting the transform , find the solution
$x(t) =$ ______________________.
Correct Answers:

- 2/(s**2*(s**2-9))
- 2*sinh(3*t)/(3**3)-2/9*t

20. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$x^{(4)}-x=0 \qquad x(0)=-7 \quad x'(0)=x''(0)=x^{(3)}(0)=0$$

First, using $X(s)$ for the Laplace transform of $x(t)$, i.e., $X(s)=\mathcal{L}\{x(t)\}$,
find the expression you get by taking the Laplace transform of the differential equation and solving for X(s).
$X(s) =$ ______________________
Now, by inverting the transform , find the solution
$x(t) =$ ______________________.
Correct Answers:

- -7*s**3/((s**2+1)*(s**2-1))
- (-7/2)*cos(t)+(-7/2)*cosh(t)

21. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$x^{(4)}+12x''+32x=0 \qquad x(0)=8 \quad x'(0)=x''(0)=x^{(3)}(0)=0$$

First, using $X(s)$ for the Laplace transform of $x(t)$, i.e., $X(s)=\mathcal{L}\{x(t)\}$,
find the expression you get by taking the Laplace transform of the differential equation and solving for X(s).
$X(s) =$ ______________________
Now, by inverting the transform , find the solution
$x(t) =$ ______________________.
Correct Answers:

- 8*s(s**2+12)/((s**2+8)*(s**2+4))
- (8/4)*(8*cos(2*t)-4*cos(2.82842712474619*t))

22. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y''-8y'+16y=0 \qquad y(0)=-5,\ y'(0)=-1$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y=\mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation
______________________ $=0$
Now solve for $Y(s) =$ ______________________
and write the above answer in its partial fraction decomposition, $Y(s)=\frac{A}{s+a}+\frac{B}{(s+a)^2}$
$Y(s) =$ ______________ + ______________
Now by inverting the transform, find $y(t) =$ ______________________.
Correct Answers:

- s^2*Y--5*s--1+-8*(s*Y--5)+16*Y
- (-5*s+39)/(s^2+-8*s+16)
- -5/(s+-4)
- 19/(s+-4)^2
- -5*exp(4*t)+19*t*exp(4*t)

23. (1 pt) Find the Laplace transform of $te^{2t}\sin(6t)$.
$\mathcal{L}\{te^{2t}\sin(6t)\} =$ ______________________.
Correct Answers:

- 2*6*(s-2)/((s-2)**2+6**2)**2

24. (1 pt) Find the Laplace transform of $t^2\sin(8t)$.
$\mathcal{L}\{t^2\sin(8t)\} =$ ______________________.
Correct Answers:

- 2*8*(3*s^2-8**2)/(s^2+8**2)**3

25. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' + 8y' - 9y = 0 \qquad y(0) = 2,\ y'(0) = 2$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation
________________ $= 0$
Now solve for $Y(s) =$ ________________
and write the above answer in its partial fraction decomposition, $Y(s) = \frac{A}{s+a} + \frac{B}{s+b}$ where $a < b$
$Y(s) =$ ____________ + ____________
Now by inverting the transform, find $y(t) =$ ________________.

Correct Answers:

- `s^2*Y-2*s-2+8*(s*Y-2)+-9*Y`
- `(2*s+18)/(s^2+8*s+-9)`
- `2/(s-1)`
- `0/(s+9)`
- `2*exp(1*t)+0*exp(-9*t)`

26. (1 pt) Use the Laplace transform to solve the following initial value problem:

$$y'' + 3y' = 0 \qquad y(0) = -2,\ y'(0) = 7$$

First, using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$,
find the equation you get by taking the Laplace transform of the differential equation
________________ $= 0$
Now solve for $Y(s) =$ ________________
and write the above answer in its partial fraction decomposition, $Y(s) = \frac{A}{s+a} + \frac{B}{s+b}$ where $a < b$
$Y(s) =$ ____________ + ____________
Now by inverting the transform, find $y(t) =$ ________________.

Correct Answers:

- `s^2*Y--2*s-7+3*(s*Y--2)`
- `(-2*s+1)/(s^2+3*s)`
- `0.333333333333333/s`
- `-2.33333333333333/(s+3)`
- `0.333333333333333+-2.33333333333333*exp(-3*t)`

27. (1 pt) Find the inverse Laplace transform of

$$\frac{3s+9}{s^2+15} \qquad s > 0$$

$y(t) =$ ________________.

Correct Answers:

- `3*cos(3.87298334620742*t)+2.32379000772445*sin(3.872983346`

28. (1 pt) Find the inverse Laplace transform of

$$\frac{2s+4}{s^2-16} \qquad s > 4$$

$y(t) =$ ________________.

Correct Answers:

- `2*cosh(4*t)+1*sinh(4*t)`

29. (1 pt) Given that

$$\mathcal{L}\left\{\frac{\cos(4\sqrt{t})}{\sqrt{\pi t}}\right\} = \frac{e^{-4/s}}{\sqrt{s}}$$

find the Laplace transform of $\sqrt{\frac{t}{\pi}}\cos(4\sqrt{t})$.
$\mathcal{L}\left\{\sqrt{\frac{t}{\pi}}\cos(4\sqrt{t})\right\} =$ ________________.

Correct Answers:

- `exp(-4/s)*(s-2*4)/(2*s^(5/2))`

30. (1 pt) Consider the following initial value problem:

$$y'' - 4y' - 32y = \sin(4t) \qquad y(0) = -4,\ y'(0) = 4$$

Using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$, find the equation you get by taking the Laplace transform of the differential equation and solve for
$Y(s) =$ ________________

Correct Answers:

- `(-4*s+20)/(s^2 - 4*s - 32)+4/((s^2 - 4*s - 32)*(s^2+16))`

31. (1 pt) Consider the following initial value problem:

$$y'' + 49y = \begin{cases} 2, & 0 \le t \le 5 \\ 0, & t > 5 \end{cases} \qquad y(0) = 2,\ y'(0) = 0$$

Using Y for the Laplace transform of $y(t)$, i.e., $Y = \mathcal{L}\{y(t)\}$, find the equation you get by taking the Laplace transform of the differential equation and solve for
$Y(s) =$ ________________

Correct Answers:

- `(2*s)/(s^2+49)+(2*(1-exp(-5*s)))/(s*(s^2+49))`