Lab Problem 3.1(a,c,d,e), Physics 430

```
> restart;
```

(a)

```
> eq:=diff(y(x),x$2)+9*y(x)=x;
```

$$\left(\frac{d}{dx}\left(\frac{d}{dx}y(x)\right)\right) + 9\,y(x) = x$$

```
> dsolve({eq,y(0)=0,y(2)=1},y(x));
```

$$y(x) = \frac{7}{9}\frac{\sin(3\,x)}{\sin(6)} + \frac{1}{9}\,x$$

(c)

```
> eq2:=diff(y(x),x$2)+diff(y(x),x)/x+(1-1/x^2)*y(x)=x;
```

$$\left(\frac{d}{dx}\left(\frac{d}{dx}y(x)\right)\right) + \frac{\frac{d}{dx}y(x)}{x} + \left(1 - \frac{1}{x^2}\right)y(x) = x$$

```
> dsolve({eq2,y(0)=0,y(5)=1},y(x));
```

(d)

```
> eqd:=diff(y(x),x$2)+sin(x)*diff(y(x),x)+exp(x)*y(x)=x^2;
```

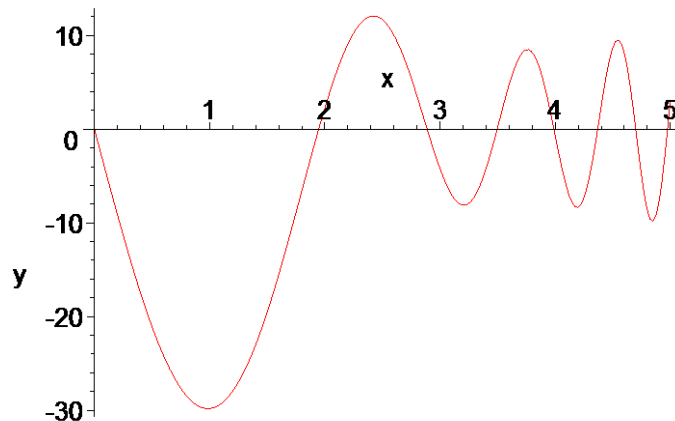$$\left(\frac{d}{dx}\left(\frac{d}{dx}y(x)\right)\right) + \sin(x)\left(\frac{d}{dx}y(x)\right) + e^x\,y(x) = x^2$$

```
> s:=dsolve({eqd,y(0)=0,y(5)=3},y(x),type=numeric,abserr=1e-5,maxmes
  h=2000);
```

$$proc(x\_bvp) \;...\; end\ proc$$

```
> s(4.5);
```

$$\left[x = 4.5,\ y(x) = 8.72062291466075656,\ \frac{d}{dx}y(x) = 35.7129461653710436\right]$$

```
> with(plots):odeplot(s,[x,y(x)],x=0..5,numpoints=200);
```
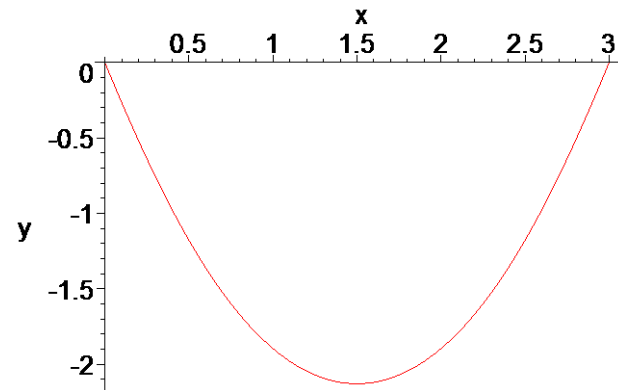
(e)

```
> eq3:=diff(y(x),x$2)+sin(y(x))=1;
```

$$\left(\frac{d}{dx} \left(\frac{d}{dx} y(x) \right) \right) + \sin(y(x)) = 1$$

```
> s:=dsolve({eq3,y(0)=0,y(3)=0},y(x),type=numeric);
```

$$proc(x\_bvp) \ ... \ end \ proc$$

```
> with(plots):
> odeplot(s,[x,y(x)],x=0..3);
```



```
>
>
>
```