Problem 1

In[1]:=
```
Exp[-2 x] // (3 ∂x,x# + 4 ∂x # - 4 # == 0) &
```
Out[1]= True

In[2]:=
```
Exp[2 x / 3] // (3 ∂x,x# + 4 ∂x # - 4 # == 0) &
```
Out[2]= True

In[3]:=
```
Cos[2 x] // (∂x,x# + 4 # == 0) &
```
Out[3]= True

In[4]:=
```
Sin[2 x] // (∂x,x# + 4 # == 0) &
```
Out[4]= True

Problem 2

In[5]:=
```
$Assumptions = a ∈ Reals && b ∈ Reals;
```

In[6]:=
```
a Exp[-2 x] + b Exp[2 x / 3] // (3 ∂x,x# + 4 ∂x # - 4 # == 0) & // Simplify
```
Out[6]= True

In[7]:=
```
a Cos[2 x] + b Sin[2 x] // (∂x,x# + 4 # == 0) & // Simplify
```
Out[7]= True

Problem 3

In[8]:=
```
DSolve[y''[t] - y'[t] - 6 y[t] == 0, y[t], t]
```
Out[8]= $\{\{y[t] \to e^{-2t} C[1] + e^{3t} C[2]\}\}$

In[9]:=
```
DSolve[2 y''[x] - 8 y'[x] + 3 y[x] == 0, y[x], x]
```
Out[9]= $\{\{y[x] \to e^{\left(2-\sqrt{\frac{5}{2}}\right)x} C[1] + e^{\left(2+\sqrt{\frac{5}{2}}\right)x} C[2]\}\}$

Problem 4

In[10]:=
```
DSolve[{x''[t] + x'[t] - 2 x[t] == 0, x[0] == 1, x'[0] == 0}, x[t], t] // Expand
```
Out[10]= $\left\{\left\{x[t] \to \frac{e^{-2t}}{3} + \frac{2 e^{t}}{3}\right\}\right\}$

In[11]:=
```
DSolve[{x''[t] + 6 x'[t] + 9 x[t] == 0, x[1] == 0, x'[1] == 1}, x[t], t]
```
Out[11]= $\{\{x[t] \to e^{3-3t} (-1 + t)\}\}$

Problem 5

In[12]:=
```
DSolve[{y''[x] + 8 y'[x] + 16 y[x] == 0, y[0] == 0, y[1] == 1}, y[x], x]
```
Out[12]= $\{\{y[x] \to e^{4-4x} x\}\}$

In[13]:=
```
DSolve[{y''[x] + 9 y[x] == 0, y[0] == 0, y[π/2] == 1}, y[x], x]
```

Out[13]=
```
{{y[x] → -Sin[3 x]}}
```

Problem 6

In[14]:=
```
DSolve[{x'[t] == -y[t], y'[t] == x[t]}, {y[t], x[t]}, t]
```

Out[14]=
```
{{x[t] → C[1] Cos[t] - C[2] Sin[t], y[t] → C[2] Cos[t] + C[1] Sin[t]}}
```