

Problem 1

`Exp[-2 x] // (3 ∂x,x + 4 ∂x - 4 == 0) &`

True

`Exp[2 x / 3] // (3 ∂x,x + 4 ∂x - 4 == 0) &`

True

`Cos[2 x] // (∂x,x + 4 == 0) &`

True

`Sin[2 x] // (∂x,x + 4 == 0) &`

True

Problem 2

`$Assumptions = a ∈ Reals && b ∈ Reals;`

`a Exp[-2 x] + b Exp[2 x / 3] // (3 ∂x,x + 4 ∂x - 4 == 0) & // Simplify`

True

`a Cos[2 x] + b Sin[2 x] // (∂x,x + 4 == 0) & // Simplify`

True

Problem 3

`DSolve[y''[t] - y'[t] - 6 y[t] == 0, y[t], t]`

`{ {y[t] → e-2t C[1] + e3t C[2]} }`

`DSolve[2 y''[x] - 8 y'[x] + 3 y[x] == 0, y[x], x]`

`{ {y[x] → e(2-√(5/2))x C[1] + e(2+√(5/2))x C[2]} }`

Problem 4

`DSolve[{x''[t] + x'[t] - 2 x[t] == 0, x[0] == 1, x'[0] == 0}, x[t], t] // Expand`

`{ {x[t] → $\frac{e^{-2t}}{3} + \frac{2e^t}{3}$ } }`

`DSolve[{x''[t] + 6 x'[t] + 9 x[t] == 0, x[1] == 0, x'[1] == 1}, x[t], t]`

`{ {x[t] → e3-3t (-1 + t)} }`

Problem 5

`DSolve[{y''[x] + 8 y'[x] + 16 y[x] == 0, y[0] == 0, y[1] == 1}, y[x], x]`

`{ {y[x] → e4-4x x} }`

```
DSolve[{y''[x] + 9 y[x] == 0, y[0] == 0, y[ $\frac{\pi}{2}$ ] == 1}, y[x], x]  
{ {y[x] -> -Sin[3 x]} }
```

Problem 6

```
DSolve[{x'[t] == -y[t], y'[t] == x[t]}, {y[t], x[t]}, t]  
{ {x[t] -> C[1] Cos[t] - C[2] Sin[t], y[t] -> C[2] Cos[t] + C[1] Sin[t]} }
```