Differential Equations

Maple has a built in **solve** feature. Try the following.

> **solve(ln(x)^2 = 16 , x) ;**

This returns $x = e^{\pm 4}$.

For differential equations *Maple* has a built in command to solve differential equations. This is the **dsolve** command. You must type **y(t)**.

> **de := diff(y(t),t) = 2*t*y(t)/(t^2+4) ;**

> **dsolve(de , y(t)) ;**

Take note that *Maple* represents the constant of integration as **_C1**. To verify that the computer got a correct solution we can assign the solution to a function of t. Do the following.

> **y := unapply(rhs(%) , t) ;**

> **y(t) ;**

> **diff(y(t) , t) ;**

> **simplify(rhs(de)) ;**

Don't forget to **restart:** before you work on a new problem to erase the definition for $y(t)$.

Also, *Maple* can solve initial-value problems. We can find a particular solution.

```
> restart:
> de := diff(y(t),t) = (cos(t) + y(t)) / cos(t) ;
> dsolve( {de , y(0) = 0} , y(t) ) ;
> y := unapply( rhs(%) , t ) ;
> plot( y(t) , t=-6..12 , y=-10..10 ) ;
```

Use *Maple* to solve the following differential equations.

$\frac{dy}{dt} = y^2$ $\quad\quad$ $\frac{dy}{dt} = -5\,y + 2\,t$

$\frac{dy}{dt} = -.25\,y^2 + 1.5\,y$ $\quad\quad$ $\frac{dy}{dt} = -.016\,y$

Now, solve the following initial value problems.

$$\frac{dy}{dt} = .08\,y \quad , \quad y(0) = 150$$

$$\frac{dy}{dt} = \frac{2\,y + 1}{t} \quad , \quad y(1) = 0$$

$$\frac{dy}{dt} = \frac{t}{y - t^2\,y} \quad , \quad y(3) = 4$$

$$\frac{dy}{dt} = (y^2 + 1)\,t \quad , \quad y(0) = 1$$

$$\frac{dy}{dt} = \frac{2}{t}\,y + 2\,t^2 \quad , \quad y(-2) = 4$$

$$\frac{dy}{dt} = \frac{2\,t}{1 + t^2}\,y + \frac{2}{1 + t^2} \quad , \quad y(0) = 2$$

Graphical Stuff

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> restart:

> with(DEtools):

> de := diff(y(t),t) = -y(t)^2 + 5*y(t) ;

> DEplot(de , y(t) , t=-3..3 , y=-2..7 , color=black) ;

> init := { [0,1],[1,1],[-1,-1],[-1,6]} ;

> DEplot(de , y(t) , t=-3..3 , init , y=-2..7 , color=black
      , linecolor=red) ;
```

Do the same for the following. You may need to change initial conditions and the t-interval.

$$\frac{dy}{dt} = -\frac{1}{t}\,y + 3\,t \qquad , \quad t = 1..5$$

$$\frac{dy}{dt} = \frac{3\,t^2 + 4\,t + 2}{2\,(y-1)} \qquad , \quad t = -3..3$$

Done in TEX.