```
> # Max Mekhanikov - HW 15 - Do not post, will redo and resubmit
  completed later
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```
> xprime := diff(x(t), t) = (4 - x(t)) · (-x(t)) · (3 - x(t))
```

$$xprime := \frac{d}{dt} x(t) = -(4 - x(t))\, x(t)\, (3 - x(t)) \tag{1}$$

```
> initcond := x(0) = 2
```

$$initcond := x(0) = 2 \tag{2}$$

```
> eq1 := dsolve([xprime, initcond])
```

$$eq1 := x(t) = \frac{3\,(e^t)^{24}}{256\left(-RootOf\left(-(e^t)^{36} + 1024\,(e^t)^{12}\,\_Z^3 + 12288\,\_Z^4\right)^3 + \frac{(e^t)^{24}}{256}\right)} \tag{3}$$

```
> initcond2 := x(0) = 3/2
```

$$initcond2 := x(0) = \frac{3}{2} \tag{4}$$

```
> eq2 := dsolve([xprime, initcond2])
```

$$eq2 := x(t) \tag{5}$$

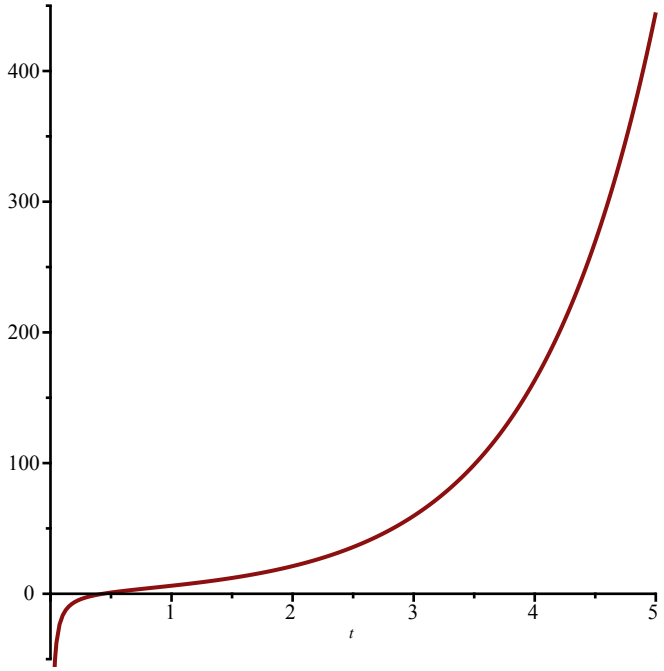
$$= \left(2187\,(e^t)^{24}\right) \Big/ \left(15625\left(-RootOf\left(-6561\,(e^t)^{36} + 562500\,(e^t)^{12}\,\_Z^3 + 1953125\,\_Z^4\right)^3 + \frac{729\,(e^t)^{24}}{15625}\right)\right)$$

```
> plot(eq1, t)
Error, (in plot) unexpected options: [x(t) = (3/256)*(exp(t))^24/(-
RootOf(-(exp(t))^36+1024*(exp(t))^12*_Z^3+12288*_Z^4)^3+(1/256)*(exp(t)
)^24), t]
```

```
> sample_eq := 3·exp(t) - 2/t
```

$$sample\_eq := 3\,e^t - \frac{2}{t} \tag{6}$$

```
> plot(sample_eq, t = 0..5)
```




```
> #Dis1(F,y,y0,h,A): The approximate orbit of the Dynamical system approximating the 1D for the
    autonomous  continuous dynamical  process dy/dt=F(y(t)) , y(0)=y0 with mesh size h from t=0
    to t=A
  Dis1 := proc(F, y, y0, h, A) local L, x, i :
  L := Orb(x + h * subs(y = x, F), x, y0, 0, trunc(A / h)) :

  L := [seq([i * h, L[i]], i = 1 ..nops(L))] :
  end:
```

```
> Dis1(sample_eq, x, 0, 0.1, 5)
```

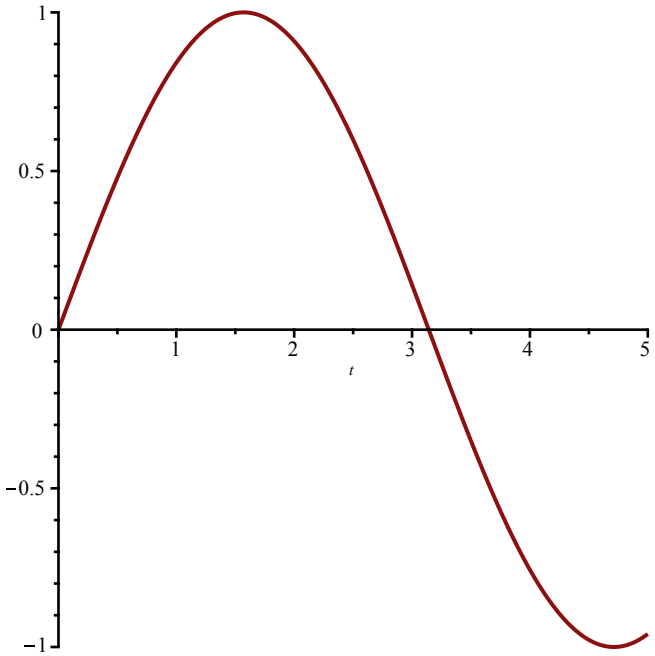
$$\left[\left[0.1, Orb\left(x + 0.3\,e^{t} - \frac{0.2}{t}, x, 0, 0, 50\right)_{1}\right], \left[0.2, Orb\left(x + 0.3\,e^{t} - \frac{0.2}{t}, x, 0, 0, 50\right)_{2}\right], \left[0.3, Orb\left(x + 0.3\,e^{t} - \frac{0.2}{t}, x, 0, 0, 50\right)_{3}\right], \left[0.4, Orb\left(x + 0.3\,e^{t} - \frac{0.2}{t}, x, 0, 0, 50\right)_{4}\right], \left[0.5, Orb\left(x + 0.3\,e^{t} - \frac{0.2}{t}, x, 0, 0, 50\right)_{5}\right]\right] \quad (7)$$

```
> Dis1(sample_eq, x, 0, 0.01, 5)
```

$$\left[\left[0.01, Orb\left(x + 0.03\,e^{t} - \frac{0.02}{t}, x, 0, 0, 500\right)_{1}\right], \left[0.02, Orb\left(x + 0.03\,e^{t} - \frac{0.02}{t}, x, 0, 0, 500\right)_{2}\right], \left[0.03, Orb\left(x + 0.03\,e^{t} - \frac{0.02}{t}, x, 0, 0, 500\right)_{3}\right], \left[0.04, Orb\left(x + 0.03\,e^{t} - \frac{0.02}{t}, x, 0, 0, 500\right)_{4}\right], \left[0.05, Orb\left(x + 0.03\,e^{t} - \frac{0.02}{t}, x, 0, 0, 500\right)_{5}\right]\right] \quad (8)$$

```
> # Had trouble with original equations and got illogical Maple
  expression above. Created sample equation for practice with syntax
  although results are pretty meaningless.
```

```
> plot(sin(t), t = 0..5)
```




```
> # Question 2
```

```
> #ToSys(k,z,f,INI): converts the kth order difference equation x(n)=f(x[n-1],x[n-2],...x[n-k]) to a
      first-order system
  #x1(n)=F(x1(n-1),x2(n-1), ...,xk(n-1))
  #x2(n)=x1(n-1)
  #...

      #xk(n)=x[k-1](n-1). It gives the underlying transformation phrased in terms of z[1],...z[k],
      followed by the initial conditions. Try:
   #ToSys:=proc(2,z,z[1] +z[2],[1,1])

  ToSys := proc(k, z, f, INI) local i :
  [f, seq(z[i-1], i = 2..k)], INI :
   end:
```

```
> ToSys(4, z, (z[1] + 2·z[2] + 3·z[3] + 11·z[4])/(z[1] + z[3]), [1, 5, 5, 2])
```

$$\left[\frac{z_1 + 2\,z_2 + 3\,z_3 + 11\,z_4}{z_1 + z_3}, z_1, z_2, z_3\right], [1, 5, 5, 2] \qquad \textbf{(9)}$$

```
> ToSys := proc(2, z, z[1] + z[2], [1, 1])
Error, unterminated procedure
                        ToSys := proc(2, z, z[1] + z[2], [1, 1])
>
```