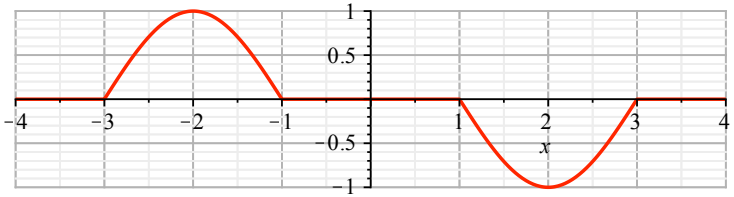
septiembre MMII - 11/12

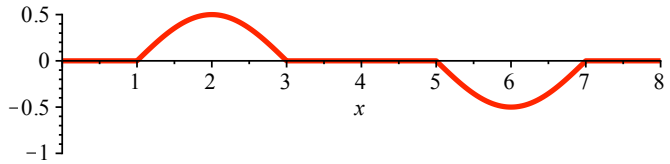
Problema 1A

```
> cs:=cos(Pi*x/2):f:=piecewise(-3<x and x<-1,-cs,1<x and x<3,cs):
  plot(f,x=-4..4,thickness=2,scaling=constrained,gridlines=true);
```




```
> with(plots):sd:=t->1/2*(subs(x=x-t,f)+subs(x=x+t,f)):
  animate(plot,[sd(t),x=0..8],t=0..4,thickness=3,frames=41);
```

$t = 4.000000000$



Problema 1B

```
> es:=diff(y(x),x$2)+x*diff(y(x),x)+y(x):
  dsolve(es=0,y(x));
  taylor(subs({_C1=1,_C2=0},sqrt(Pi/2)/I*rhs(%)),x);
  dsolve(es=0,y(x),series):
  [subs({y(0)=0,D(y)(0)=1},%),subs({y(0)=1,D(y)(0)=0},%)];
```

$$y(x) = \frac{\operatorname{erf}\left(\frac{1}{2} I \sqrt{2}\, x\right) \_C1}{e^{\frac{1}{2} x^2}} + \frac{\_C2}{e^{\frac{1}{2} x^2}}$$

$$x - \frac{1}{3} x^3 + \frac{1}{15} x^5 + O(x^6)$$

$$\left[y(x) = x - \frac{1}{3} x^3 + \frac{1}{15} x^5 + O(x^6),\ y(x) = 1 - \frac{1}{2} x^2 + \frac{1}{8} x^4 + O(x^6)\right] \quad (1)$$

Problema 1C

```
> e2:=x*diff(y(x),x$2)-2*diff(y(x),x):
  dsolve(e2=0,y(x));dsolve({e2=0,y(1)+D(y)(1)=0,y(2)=0},y(x));
  dsolve(e2=2,y(x));dsolve({e2=2,y(1)+D(y)(1)=0,y(2)=0},y(x));
```

$$y(x) = \_C1 + \_C2\, x^3$$

$$y(x) = 0$$

$$y(x) = \frac{1}{3} x^3\, \_C1 - x + \_C2$$

$$y(x) = 2 - x \quad (2)$$

Problema 2

```
> cc:=diff(u(x,t),t)-diff(u(x,t),x$2)/t:
  [dsolve({diff(T(t),t)+T(t)/t=2,T(1)=0},T(t)),
  dsolve({diff(T(t),t)+9*T(t)/t=0,T(1)=1},T(t))];
  sm:=(t-1/t)*cos(x)+cos(3*x)/t^9:
  normal(eval([subs(u(x,t)=sm,cc),subs(t=1,sm),
  subs(x=0,diff(sm,x)),subs(x=Pi/2,sm)]));
```

$$\left[T(t) = t - \frac{1}{t},\ T(t) = \frac{1}{t^9}\right]$$

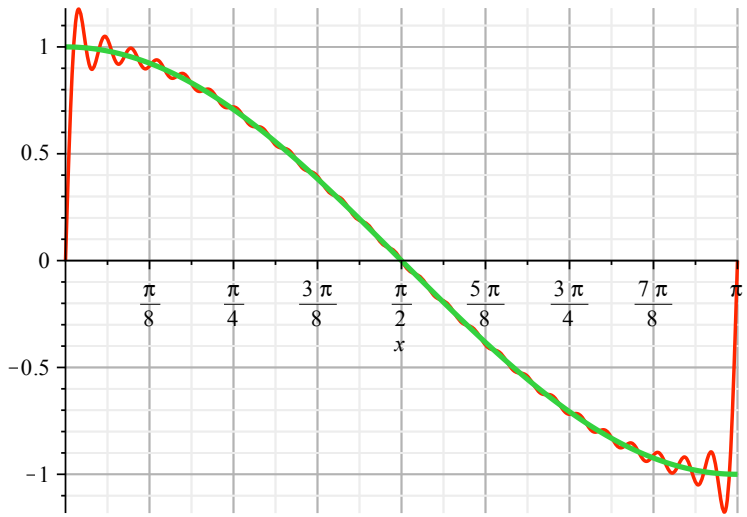
$$[2\cos(x), \cos(3x), 0, 0] \quad (3)$$

Problema 3

```
> Xn:=sin(n*x):
  bn:=2/Pi*int(cos(x)*Xn,x=0..Pi) assuming n::integer:
  b1:=2/Pi*int(cos(x)*sin(x),x=0..Pi):[bn,b1];
  int(sin((n+1)*x)+sin((n-1)*x),x=0..Pi)/Pi-bn
     assuming n::integer;
  plot([sum(bn*Xn,n=2..50),cos(x)],x=0..Pi,
  thickness=[2,3],scaling=constrained,gridlines=true);
```

$$\left[\frac{2\left(1 + (-1)^n\right) n}{\pi\left(-1 + n^2\right)}, 0\right]$$

$$0$$



Problema 4

```
> e1:=t*diff(u(x,t),t)-diff(u(x,t),x)=u(x,t):s1:=t^3*exp(2*x):
  [pdsolve(e1,u(x,t)),eval(subs(u(x,t)=s1,e1)),subs(t=1,s1)];
```

$$\left[u(x,t) = \_F1\left(t\, e^x\right) e^{-x},\ t^3 e^{2x} = t^3 e^{2x},\ e^{2x}\right] \quad (4)$$