Assignment 2 Question 1   Spring 2015

▼ part (a)

```
> EEA := proc(a,b,x) local r,s,t,k,q,u,g;
      r[0],r[1] := a,b;
      s[0],s[1] := 1,0;
      t[0],t[1] := 0,1;
      k := 1;
      while r[k] <> 0 do
          q := quo(r[k-1],r[k],x);
          r[k+1] := expand(r[k-1]-q*r[k]);
          s[k+1] := expand(s[k-1]-q*s[k]);
          t[k+1] := expand(t[k-1]-q*t[k]);
          k := k+1;
          printf("r[%d]=%a\n",k,r[k]);
          printf("s[%d]=%a\n",k,s[k]);
          printf("t[%d]=%a\n",k,t[k]);
      od;
      u := lcoeff(r[k-1]);
      g := r[k-1]/u;  # Make g monic by dividing
      s := s[k-1]/u;  #   s a + t b = g by u
      t := t[k-1]/u;
      return (g,s,t);
   end:
```

```
> a := expand((x+1)*(2*x^4-3*x^3+5*x^2+3*x-1));
```
$$a := 2\,x^5 - x^4 + 2\,x^3 + 8\,x^2 + 2\,x - 1$$

```
> b := expand((x+1)*(7*x^4+5*x^3-2*x^2-x+4));
```
$$b := 7\,x^5 + 12\,x^4 + 3\,x^3 - 3\,x^2 + 3\,x + 4$$

```
> g,s,t := EEA(a,b,x);
r[2]=-31/7*x^4+8/7*x^3+62/7*x^2+8/7*x-15/7
s[2]=1
t[2]=-2/7
r[3]=19761/961*x^3+819/31*x^2+3052/961*x-2576/961
s[3]=2996/961+49/31*x
t[3]=105/961-14/31*x
r[4]=14177633/18595101*x^2-9106436/18595101*x-23284069/18595101
s[4]=-667895/18595101+906223/6198367*x+961/2823*x^2
t[4]=-1995997/6198367+3227999/18595101*x-1922/19761*x^2
r[5]=13051647258853/209162619649*x+13051647258853/209162619649
s[5]=1042546734299/209162619649-1056158348231/209162619649*
x-4525452540168/209162619649*x^2-130165707/14177633*x^3
t[5]=3523548498288/209162619649-165062513210/209162619649*x+78080829099/209162619649*
x^2+37190202/14177633*x^3
r[6]=0
s[6]=836650478596/13051647258853-209162619649/13051647258853*
x-418325239298/13051647258853*x^2+1045813098245/13051647258853*
x^3+209162619649/1864521036979*x^4
t[6]=209162619649/13051647258853-627487858947/13051647258853*
x-1045813098245/13051647258853*x^2+627487858947/13051647258853*x^3
-418325239298/13051647258853*x^4
```
$$g,\,s,\,t := x+1,\ \frac{168197}{2105659} - \frac{170393}{2105659}\,x - \frac{730104}{2105659}\,x^2 - \frac{309813}{2105659}\,x^3,\ \frac{568464}{2105659}$$

$$-\frac{26630}{2105659}\,x+\frac{12597}{2105659}\,x^2+\frac{88518}{2105659}\,x^3$$

```
> gcdex(a,b,x,'s1','t1');
```
$$x+1$$

```
> s1-s;
```
$$0$$

```
> t1-t;
```
$$0$$

part (b)

```
> a := x^3-1; b := x^2+1; c := x^2;
```
$$a:=x^3-1$$
$$b:=x^2+1$$
$$c:=x^2$$

```
> g := gcdex(a,b,x,'s','t');
```
$$g:=1$$

Obviously g|c here so we proceed
```
> sigma := rem(c*s,b,x,'q');
```
$$\sigma:=-\frac{1}{2}\,x+\frac{1}{2}$$

```
> tau := expand( c*t+q*a );
```
$$\tau:=\frac{1}{2}-\frac{1}{2}\,x+\frac{1}{2}\,x^2$$

Check that $\sigma\,a+\tau\,b=c$
```
> expand( sigma*a+tau*b - c );
```
$$0$$