Zad 5. Marcin G.

Zadanie domowe

1.a)

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

$$\text{ilorazy} \quad \text{zero} \quad \text{pierwszy} \quad \text{drugi} \quad \text{trzeci}$$

$$y_0=0 \quad y_0=0 \qquad f_{[0,1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$y_1=1 \quad y_1=1 \qquad f_{[1,2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{2-1}{2-1}=1$$

$$y_2=2 \quad y_2=2 \qquad f_{[2,3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{3-2}{3-2}=1$$

$$y_3=3 \quad y_3=3$$

$$f_{[0,1,2]}=\frac{f_{[1,2]}-f_{[0,1]}}{x_2-x_0}=\frac{1-1}{2-0}=0$$

$$f_{[1,2,3]}=\frac{f_{[2,3]}-f_{[1,2]}}{x_3-x_1}=\frac{1-1}{3-1}=0$$

$$f_{[0,1,2,3]}=\frac{f_{[1,2,3]}-f_{[0,1,2]}}{x_3-x_0}=\frac{0-0}{3-0}=0$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=0
f[0,1,2,3]=0
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

1.b)

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=4$
$x_3=3$	$y_3=9$

$$\text{ilorazy} \quad \text{zero} \quad \text{pierwszy} \quad \text{drugi} \quad \text{trzeci}$$

$$y_0=0 \quad y_0=0 \qquad f_{[0,1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$y_1=1 \quad y_1=1 \qquad f_{[1,2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{4-1}{2-1}=3$$

$$y_2=4 \quad y_2=4 \qquad f_{[2,3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{9-4}{3-2}=5$$

$$y_3=9 \quad y_3=9$$

$$f_{[0,1,2]}=\frac{f_{[1,2]}-f_{[0,1]}}{x_2-x_0}=\frac{3-1}{2-0}=1$$

$$f_{[1,2,3]}=\frac{f_{[2,3]}-f_{[1,2]}}{x_3-x_1}=\frac{5-3}{3-1}=1$$

$$f_{[0,1,2,3]}=\frac{f_{[1,2,3]}-f_{[0,1,2]}}{x_3-x_0}=\frac{1-1}{3-0}=0$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=1
f[0,1,2,3]=0
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*1+(x-0)*(x-1)*(x-2)*0
N(x)=x+x*(x-1)
```

1.c)

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=8$
$x_3=3$	$y_3=27$

$$\text{ilorazy} \quad \text{zero} \quad \text{pierwszy} \quad \text{drugi} \quad \text{trzeci}$$

$$y_0=0 \quad y_0=0 \qquad f_{[0,1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$y_1=1 \quad y_1=1 \qquad f_{[1,2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{8-1}{2-1}=7$$

$$y_2=8 \quad y_2=8 \qquad f_{[2,3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{27-8}{3-2}=19$$

$$y_3=27 \quad y_3=27$$

$$f_{[0,1,2]}=\frac{f_{[1,2]}-f_{[0,1]}}{x_2-x_0}=\frac{7-1}{2-0}=3$$

$$f_{[1,2,3]}=\frac{f_{[2,3]}-f_{[1,2]}}{x_3-x_1}=\frac{19-7}{3-1}=6$$

$$f_{[0,1,2,3]}=\frac{f_{[1,2,3]}-f_{[0,1,2]}}{x_3-x_0}=\frac{6-3}{3-0}=1$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=3
f[0,1,2,3]=1
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*3+(x-0)*(x-1)*(x-2)*1
N(x)=x+3*x*(x-1)+x*(x-1)*(x-2)
```

2.a) $f(x)=\frac{1}{x}$

	$f(x)$
$x_0=1$	$y_0=1$
$x_1=2$	$y_1=\frac{1}{2}$
$x_2=3$	$y_2=\frac{1}{3}$
$x_3=4$	$y_3=\frac{1}{4}$

Oto wzór na ilorazy różnicowe dla długości 3 pkt.

$$f_{[x_0,x_1,x_2]}=\frac{1}{(x_0-x_1)(x_0-x_2)}+\frac{1}{(x_1-x_0)(x_1-x_2)}+\frac{1}{(x_2-x_0)(x_2-x_1)}$$

2.b) $f(x)=\sin x$

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=\frac{\pi}{2}$	$y_1=1$
$x_2=\pi$	$y_2=0$
$x_3=\frac{3\pi}{2}$	$y_3=-1$

Oto wzór na ilorazy różnicowe dla długości 3 pkt.

$$f_{[x_0,x_1,x_2]}=\frac{f(x_0)}{(x_0-x_1)(x_0-x_2)}+\frac{f(x_1)}{(x_1-x_0)(x_1-x_2)}+\frac{f(x_2)}{(x_2-x_0)(x_2-x_1)}$$

```
Wzór na ilorazy różnicowe dla długości 3 pkt.
function [f]=ilorazy(x,y,x0,x1,x2)
f=y(1)/((x0-x1)*(x0-x2))+y(2)/((x1-x0)*(x1-x2))+y(3)/((x2-x0)*(x2-x1))
end
```

2.c) $f(x)=\frac{1}{1+x^2}$

	$f(x)$
$x_0=-1$	$y_0=\frac{1}{2}$
$x_1=0$	$y_1=1$
$x_2=1$	$y_2=\frac{1}{2}$

$$f_{[x_0,x_1,x_2]}=\frac{f(x_0)}{(x_0-x_1)(x_0-x_2)}+\frac{f(x_1)}{(x_1-x_0)(x_1-x_2)}+\frac{f(x_2)}{(x_2-x_0)(x_2-x_1)}$$

```
Wzór na ilorazy różnicowe dla długości 3 pkt.
function [f]=ilorazy(x,y,x0,x1,x2)
f=y(1)/((x0-x1)*(x0-x2))+y(2)/((x1-x0)*(x1-x2))+y(3)/((x2-x0)*(x2-x1))
end
```

3.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{2-1}{2-1}=1$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{3-2}{3-2}=1$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{1-1}{2-0}=0$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{1-1}{3-1}=0$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{0-0}{3-0}=0$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=0
f[0,1,2,3]=0
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

4.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

$$\text{ilorazy} \quad \text{zero} \quad \text{pierwszy} \quad \text{drugi} \quad \text{trzeci}$$

$$y_0=0 \quad y_0=0 \qquad f_{[0,1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$y_1=1 \quad y_1=1 \qquad f_{[1,2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{2-1}{2-1}=1$$

$$y_2=2 \quad y_2=2 \qquad f_{[2,3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{3-2}{3-2}=1$$

$$y_3=3 \quad y_3=3$$

$$f_{[0,1,2]}=\frac{f_{[1,2]}-f_{[0,1]}}{x_2-x_0}=\frac{1-1}{2-0}=0$$

$$f_{[1,2,3]}=\frac{f_{[2,3]}-f_{[1,2]}}{x_3-x_1}=\frac{1-1}{3-1}=0$$

$$f_{[0,1,2,3]}=\frac{f_{[1,2,3]}-f_{[0,1,2]}}{x_3-x_0}=\frac{0-0}{3-0}=0$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=0
f[0,1,2,3]=0
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

5.a) $f(x)=\frac{1}{x}$

	$f(x)$
$x_0=1$	$y_0=1$
$x_1=2$	$y_1=\frac{1}{2}$
$x_2=3$	$y_2=\frac{1}{3}$
$x_3=4$	$y_3=\frac{1}{4}$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{\frac{1}{2}-1}{2-1}=-\frac{1}{2}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{\frac{1}{3}-\frac{1}{2}}{3-2}=-\frac{1}{6}$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{\frac{1}{4}-\frac{1}{3}}{4-3}=-\frac{1}{12}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{1}{6}+\frac{1}{2}}{3-1}=\frac{1}{6}$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{-\frac{1}{12}+\frac{1}{6}}{4-2}=\frac{1}{12}$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{\frac{1}{12}-\frac{1}{6}}{4-1}=-\frac{1}{36}$$

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

5.b) $f(x)=\sin x$

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=\frac{\pi}{2}$	$y_1=1$
$x_2=\pi$	$y_2=0$
$x_3=\frac{3\pi}{2}$	$y_3=-1$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{\frac{\pi}{2}-0}=\frac{2}{\pi}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{0-1}{\pi-\frac{\pi}{2}}=-\frac{2}{\pi}$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{-1-0}{\frac{3\pi}{2}-\pi}=-\frac{2}{\pi}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{2}{\pi}-\frac{2}{\pi}}{\pi-0}=-\frac{4}{\pi^2}$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{-\frac{2}{\pi}+\frac{2}{\pi}}{\frac{3\pi}{2}-\frac{\pi}{2}}=0$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{0+\frac{4}{\pi^2}}{\frac{3\pi}{2}-0}=\frac{8}{3\pi^3}$$

```
Diagram ilorazów
f[0]=0
f[0,1]=2/pi
f[0,1,2]=-4/pi^2
f[0,1,2,3]=8/(3*pi^3)
```

```
Wielomian Newtona
N(x)=0+(x-0)*2/pi+(x-0)*(x-pi/2)*(-4/pi^2)+(x-0)*(x-pi/2)*(x-pi)*8/(3*pi^3)
N(x)=2*x/pi-4*x*(x-pi/2)/pi^2+8*x*(x-pi/2)*(x-pi)/(3*pi^3)
```

5.c) $f(x)=\frac{1}{1+x^2}$

	$f(x)$
$x_0=-1$	$y_0=\frac{1}{2}$
$x_1=0$	$y_1=1$
$x_2=1$	$y_2=\frac{1}{2}$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-\frac{1}{2}}{0+1}=\frac{1}{2}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{\frac{1}{2}-1}{1-0}=-\frac{1}{2}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{1}{2}-\frac{1}{2}}{1+1}=-\frac{1}{2}$$

```
Diagram ilorazów
f[0]=1/2
f[0,1]=1/2
f[0,1,2]=-1/2
```

```
Wielomian Newtona
N(x)=1/2+(x+1)*1/2+(x+1)*(x-0)*(-1/2)
N(x)=1/2+(x+1)/2-(x+1)*x/2
```

6.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{1-0}=1$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{2-1}{2-1}=1$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{3-2}{3-2}=1$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{1-1}{2-0}=0$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{1-1}{3-1}=0$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{0-0}{3-0}=0$$

```
Diagram ilorazów
f[0]=0
f[0,1]=1
f[0,1,2]=0
f[0,1,2,3]=0
```

```
Wielomian Newtona
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

7.a) $f(x)=\frac{1}{x}$

	$f(x)$
$x_0=1$	$y_0=1$
$x_1=2$	$y_1=\frac{1}{2}$
$x_2=3$	$y_2=\frac{1}{3}$
$x_3=4$	$y_3=\frac{1}{4}$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{\frac{1}{2}-1}{2-1}=-\frac{1}{2}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{\frac{1}{3}-\frac{1}{2}}{3-2}=-\frac{1}{6}$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{\frac{1}{4}-\frac{1}{3}}{4-3}=-\frac{1}{12}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{1}{6}+\frac{1}{2}}{3-1}=\frac{1}{6}$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{-\frac{1}{12}+\frac{1}{6}}{4-2}=\frac{1}{12}$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{\frac{1}{12}-\frac{1}{6}}{4-1}=-\frac{1}{36}$$

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

7.b) $f(x)=\sin x$

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=\frac{\pi}{2}$	$y_1=1$
$x_2=\pi$	$y_2=0$
$x_3=\frac{3\pi}{2}$	$y_3=-1$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-0}{\frac{\pi}{2}-0}=\frac{2}{\pi}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{0-1}{\pi-\frac{\pi}{2}}=-\frac{2}{\pi}$$

$$f_{[x_2,x_3]}=\frac{y_3-y_2}{x_3-x_2}=\frac{-1-0}{\frac{3\pi}{2}-\pi}=-\frac{2}{\pi}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{2}{\pi}-\frac{2}{\pi}}{\pi-0}=-\frac{4}{\pi^2}$$

$$f_{[x_1,x_2,x_3]}=\frac{f_{[x_2,x_3]}-f_{[x_1,x_2]}}{x_3-x_1}=\frac{-\frac{2}{\pi}+\frac{2}{\pi}}{\frac{3\pi}{2}-\frac{\pi}{2}}=0$$

$$f_{[x_0,x_1,x_2,x_3]}=\frac{f_{[x_1,x_2,x_3]}-f_{[x_0,x_1,x_2]}}{x_3-x_0}=\frac{0+\frac{4}{\pi^2}}{\frac{3\pi}{2}-0}=\frac{8}{3\pi^3}$$

```
Diagram ilorazów
f[0]=0
f[0,1]=2/pi
f[0,1,2]=-4/pi^2
f[0,1,2,3]=8/(3*pi^3)
```

```
Wielomian Newtona
N(x)=0+(x-0)*2/pi+(x-0)*(x-pi/2)*(-4/pi^2)+(x-0)*(x-pi/2)*(x-pi)*8/(3*pi^3)
N(x)=2*x/pi-4*x*(x-pi/2)/pi^2+8*x*(x-pi/2)*(x-pi)/(3*pi^3)
```

7.c) $f(x)=\frac{1}{1+x^2}$

	$f(x)$
$x_0=-1$	$y_0=\frac{1}{2}$
$x_1=0$	$y_1=1$
$x_2=1$	$y_2=\frac{1}{2}$

$$f_{[x_0,x_1]}=\frac{y_1-y_0}{x_1-x_0}=\frac{1-\frac{1}{2}}{0+1}=\frac{1}{2}$$

$$f_{[x_1,x_2]}=\frac{y_2-y_1}{x_2-x_1}=\frac{\frac{1}{2}-1}{1-0}=-\frac{1}{2}$$

$$f_{[x_0,x_1,x_2]}=\frac{f_{[x_1,x_2]}-f_{[x_0,x_1]}}{x_2-x_0}=\frac{-\frac{1}{2}-\frac{1}{2}}{1+1}=-\frac{1}{2}$$

```
Diagram ilorazów
f[0]=1/2
f[0,1]=1/2
f[0,1,2]=-1/2
```

```
Wielomian Newtona
N(x)=1/2+(x+1)*1/2+(x+1)*(x-0)*(-1/2)
N(x)=1/2+(x+1)/2-(x+1)*x/2
```

8. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

9. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

10. Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

11.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

a) $x_0=0$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

b) $x_0=1$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

c) $x_0=2$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

d) $x_0=3$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

12. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

13. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

14. Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

15.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

a) $x_0=0$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

b) $x_0=1$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

c) $x_0=2$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

d) $x_0=3$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

16. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

17. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

18. Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

19. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

20. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

21. Zrób to na ćwi. 10 na str 17 Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

22.

	$f(x)$
$x_0=0$	$y_0=0$
$x_1=1$	$y_1=1$
$x_2=2$	$y_2=2$
$x_3=3$	$y_3=3$

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

a) $x_0=0$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

b) $x_0=1$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

c) $x_0=2$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

d) $x_0=3$

$$N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0$$

$$N(x)=x+x*(x-1)+x*(x-1)*(x-2)$$

$$N(x)=x+x^2-x+(x^2-x)*(x-2)$$

$$N(x)=x+x^2-x+x^3-2x^2-x^2+2x$$

$$N(x)=x^3-2x^2+2x$$

23. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

24. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

25. Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```

26. Zrób to na ćwi. 10 na str 17 Diagram ilorazów

```
Diagram ilorazów
f[0]=1
f[0,1]=-1/2
f[0,1,2]=1/6
f[0,1,2,3]=-1/36
```

27. Zrób to na ćwi. 10 na str 17 Wielomian Newtona

```
Wielomian Newtona
N(x)=1-(x-1)*1/2+(x-1)*(x-2)*1/6-(x-1)*(x-2)*(x-3)*1/36
N(x)=1-(x-1)/2+(x-1)*(x-2)/6-(x-1)*(x-2)*(x-3)/36
```

28. Wzór Horner

```
Wzór Horner
N(x)=0+(x-0)*1+(x-0)*(x-1)*0+(x-0)*(x-1)*(x-2)*0
N(x)=x
```