

Divided differences

Divided differences  $[f(x_1)-f(x_0)]/[x_1-x_0]$

x	$x^3$	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
0	0				
1	1				
2	8				
3	27				
4	64				
5	125				
6	216				
7	343				
8	512				
9	729				
10	1000				

Simple differences  $f(x+1)-f(x)$

x	$x^3$	1 <sup>st</sup> diff	2 <sup>nd</sup> diff	3 <sup>rd</sup> diff	4 <sup>th</sup> diff
0	0				
1	1				
2	8				
3	27				
4	64				
5	125				
6	216				
7	343				
8	512				
9	729				
10	1000				

x	$x^3$	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
1	1				
2	8				
5	125				
7	343				
10	1000				

x	$x^3$	1 <sup>st</sup> diff	2 <sup>nd</sup> diff	3 <sup>rd</sup> diff	4 <sup>th</sup> diff
1					
2					
5		Awk			
7					
10					

x	$3^x$	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
0	1				
1	3				
2	9				
3	27				
4	81				
5	243				
6	729				
7	2187				

x	$3^x$	1 <sup>st</sup> diff.	2 <sup>nd</sup> diff.	3 <sup>rd</sup> diff.	4 <sup>th</sup> diff.
0	1				
1	3				
2	9				
3	27				
4	81				
5	243				
6	729				
7	2187				

x	f(x)	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
1	-2				
2	2				
3	14				
4	40				
5	86				
6	158				

x	f(x)	1 <sup>st</sup> diff.	2 <sup>nd</sup> diff.	3 <sup>rd</sup> diff.	4 <sup>th</sup> diff.
1	-2				
2	2				
3	14				
4	40				
5	86				
6	158				

Divided differences\_2

Divided differences  $[f(x_1)-f(x_0)]/[x_1-x_0]$

Simple differences  $f(x+1)-f(x)$

x	x <sup>3</sup>	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
0	0	1	3	1	0
1	1	7	6	1	0
2	8	19	9	1	0
3	27	37	12	1	0
4	64	61	15	1	0
5	125	91	18	1	0
6	216	127	21	1	0
7	343	169	24	1	
8	512	217	27		
9	729	271			
10	1000				

x	x <sup>3</sup>	1 <sup>st</sup> diff	2 <sup>nd</sup> diff	3 <sup>rd</sup> diff	4 <sup>th</sup> diff
0	0	1	6	6	0
1	1	7	12	6	0
2	8	19	18	6	0
3	27	37	24	6	0
4	64	61	30	6	0
5	125	91	36	6	0
6	216	127	42	6	0
7	343	169	48	6	
8	512	217	54		
9	729	271			
10	1000				

x	x <sup>3</sup>	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
1	1	7	8	1	0
2	8	39	14	1	
5	125	109	22		
7	343	219			
10	1000				

x	x <sup>3</sup>	1 <sup>st</sup> diff	2 <sup>nd</sup> diff	3 <sup>rd</sup> diff	4 <sup>th</sup> diff
1	1				
2	8				
5	125	Awk			
7	343				
10	1000				

x	3 <sup>x</sup>	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
0	1	2	2	1.33	0.67
1	3	6	6	4	2
2	9	18	18	12	6
3	27	54	54	36	18
4	81	162	162	108	
5	243	486	486		
6	729	1458			
7	2187				

x	3 <sup>x</sup>	1 <sup>st</sup> diff.	2 <sup>nd</sup> diff.	3 <sup>rd</sup> diff.	4 <sup>th</sup> diff.
0	1	2	4	8	16
1	3	6	12	24	48
2	9	18	36	72	144
3	27	54	108	216	
4	81	162	324		
5	243	486			
6	729				
7	2187				

x	f(x)	1 <sup>st</sup> d.d.	2 <sup>nd</sup> d.d.	3 <sup>rd</sup> d.d.	4 <sup>th</sup> d.d.
1	-2	4	4	1	0
2	2	12	7	1	0
3	14	26	10	1	
4	40	46	13		
5	86	72			
6	158				

x	f(x)	1 <sup>st</sup> diff.	2 <sup>nd</sup> diff.	3 <sup>rd</sup> diff.	4 <sup>th</sup> diff.
1	-2	4	8	6	0
2	2	12	14	6	0
3	14	26	20	6	
4	40	46	26		
5	86	72			
6	158				

$f(x) = x^3 - 2x^2 + 3x - 4.$

## Homework

### Set 2 homework

Complete the tables of divided differences and simple differences.  
Determine the most likely values of  $g(10)$  and  $g(12)$

#### Divided differences

x	g(x)					
-8	829					
-6	407					
-4	161					
-2	43					
0	5					
2	-1					
4	-23					
6	-109					
8	-307					

#### Simple differences

x	g(x)					
-8	829					
-6	407					
-4	161					
-2	43					
0	5					
2	-1					
4	-23					
6	-109					
8	-307					