

AP Calculus

Introduction to Calculus

AP Calculus is the study of:

1. **Limits** - Determining the value of $f(x)$ as the value of x approaches a specified value.
2. **Derivatives** - A measure of the rate of change of a function and its application to real-world problems.
3. **Integrals** - A measure of the net accumulation of change in the value of $f(x)$ over a given interval of x and its application to real-world problems.
4. First-order separable **Differential Equations**.

What do Newton, Leibniz and Bolt have in common???



Rate of Change of a Function

The rate of change of a function is a measure of:

_____ = _____ = _____ = _____

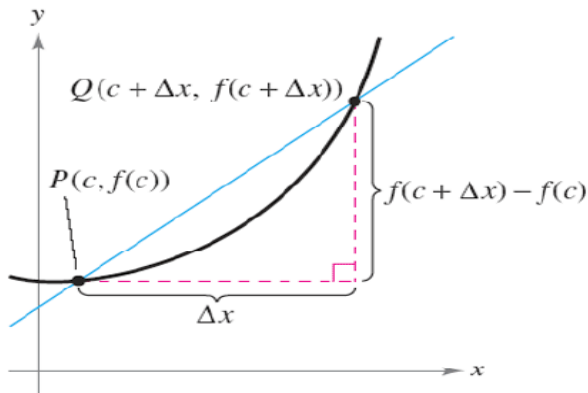
e.g.

We will study 2 types of ROC:

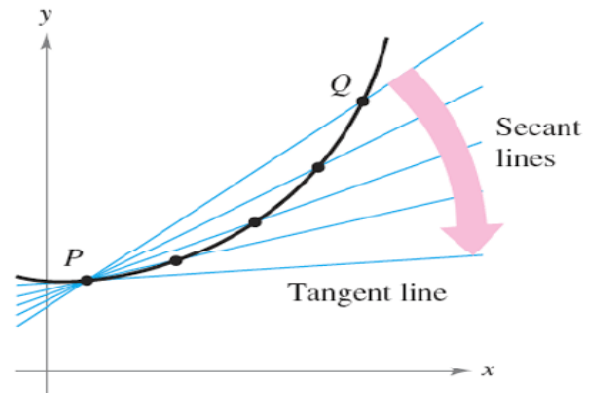
Average ROC: Change in y over a change in x from $x = a$ to $x = b$ where _____

Instantaneous ROC: Change of y over a change in x from $x = a$ to $x = b$ where _____

The Tangent Line Problem - the reason why we need to study LIMITS!



(a) The secant line through $(c, f(c))$ and $(c + \Delta x, f(c + \Delta x))$



(b) As Q approaches P , the secant lines approach the tangent line.

Time	Distance
0.0	0.000
0.1	3.241
0.2	5.645
0.3	5.973
0.4	6.319
0.5	6.684
0.6	7.068
0.7	7.473
0.8	7.899
0.9	8.346
1.0	8.817
1.1	9.312
1.2	9.831
1.3	10.376
1.4	10.948
1.5	11.547
1.6	12.174
1.7	12.831
1.8	13.517
1.9	14.235
2.0	14.984
2.1	15.765
2.2	16.578
2.3	17.425
2.4	18.306
2.5	19.222
2.6	20.171
2.7	21.156
2.8	22.175
2.9	23.229
3.0	24.317
3.1	25.439
3.2	26.595
3.3	27.785
3.4	29.006
3.5	30.259
3.6	31.542
3.7	32.854
3.8	34.193
3.9	35.558
4.0	36.948
4.1	38.359
4.2	39.790
4.3	41.240
4.4	42.705

Time	Distance
4.5	44.183
4.6	45.671
4.7	47.168
4.8	48.670
4.9	50.175
5.0	51.680
5.1	53.182
5.2	54.679
5.3	56.167
5.4	57.645
5.5	59.110
5.6	60.560
5.7	61.991
5.8	63.402
5.9	64.792
6.0	66.157
6.1	67.496
6.2	68.808
6.3	70.091
6.4	71.344
6.5	72.565
6.6	73.755
6.7	74.911
6.8	76.033
6.9	77.121
7.0	78.175
7.1	79.194
7.2	80.179
7.3	81.128
7.4	82.044
7.5	82.925
7.6	83.772
7.7	84.585
7.8	85.366
7.9	86.115
8.0	86.833
8.1	87.519
8.2	88.176
8.3	88.803
8.4	89.402
8.5	89.974
8.6	90.519
8.7	91.038
8.8	91.533
8.9	92.004

Time	Distance
9.1	93.705
9.2	94.777
9.3	96.808
9.4	98.234
9.5	99.950
9.6	100.000

Time and Distance Values for Usain Bolt's 100m Sprint

