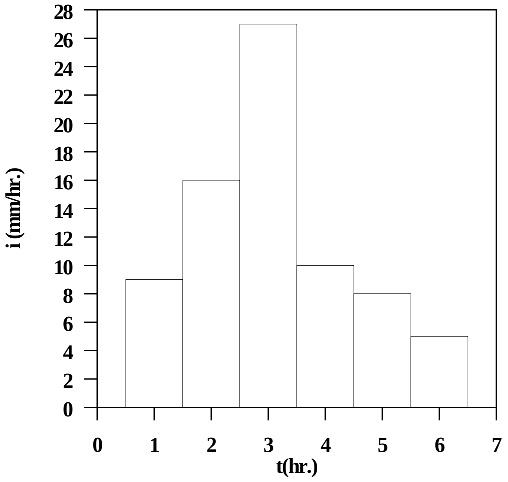
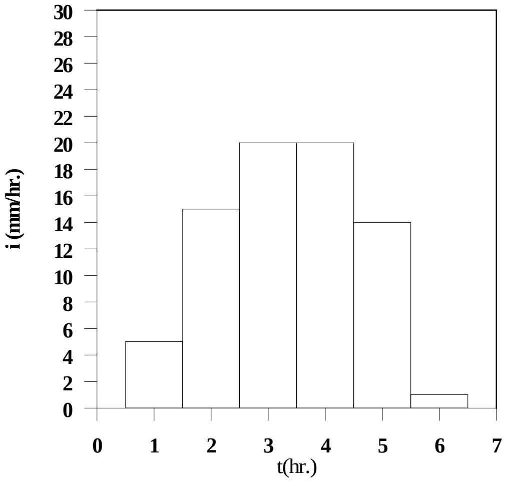
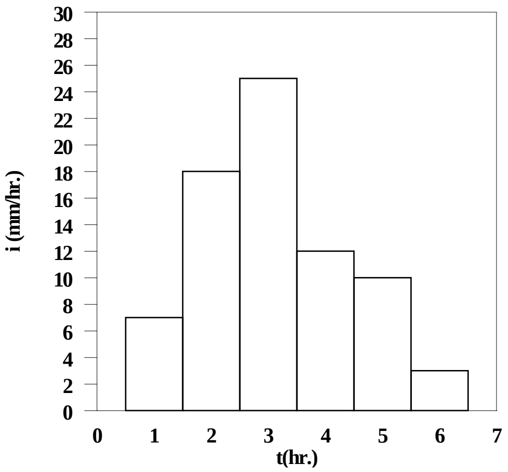
Example$_1$: Find the Index of a certain catchment has the change of the rainfall intensity which given below. If the **runoff=33mm**, **P=75mm**







Example$_2$: A tabulated below are data for a number of storms happened on a river. Compute the W-index for all storms, what would be the av. Error and av. Percentage error in estimated runoff .If the av. W-index was used to compute the runoff?

Storm no.	Duration,t (hr.)	P (cm)	$R_{ob.}$ (cm)	W-index (cm/hr.)	$R_{comp.}$=P-W*t	Error=$R_{comp.}$-$R_{ob.}$
1	12	2.82	1.32	0.125	1.2	-0.12
2	48	2.98	1.02	0.041	0	-1.02
3	24	4.55	2.46	0.087	1.31	-1.15
4	72	14.22	7.42	0.094	4.5	-2.92
5	18	2.87	0.43	0.136	0.44	0.01
6	24	3.91	0.48	0.143	0.67	0.19
7	36	8.1	1.93	0.171	3.24	1.31
8	12	4.41	1.67	0.228	2.79	1.12
9	30	5.31	1.98	0.111	1.26	-0.72
10	18	6.98	3.15	0.213	4.55	1.4
			∑=21.86	∑=1.35	∑=19.96	∑=-1.9
				(W) ave = 1.35/10 = 0.135		Error=-0.19

For check:

$$Av.\ Error = (\sum R_{comp.} - \sum R_{ob.})/10$$
$$= (19.96-21.86)/10$$
$$=-0.19 \qquad \text{ok.}$$

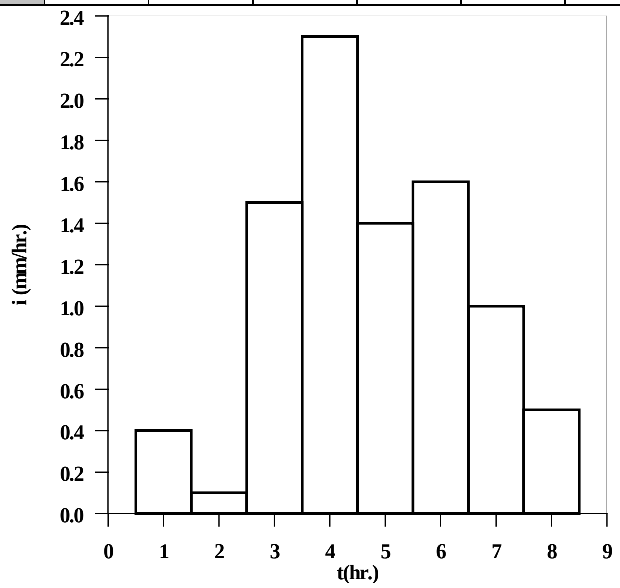
Example$_3$: A rain storm with intensity=**10cm** and direct runoff=**5.8cm** If the distribution of the storm as given in table below.

Find the

Φ-Index for the storm

t(hr.)	1	2	3	4	5	6	7	8
Excess	0.4	0.1	1.5	2.3	1.4	1.6	1	0.5

rainfall/hr.								



<u>Example$_4$:</u>The equation of the **f(t)** curve for a certain catchment is given by:

$$\mathbf{f(t) = 1.2 + 4.2\, e^{-0.33t}}$$

1-Compute the runoff volume for the following rain storm:

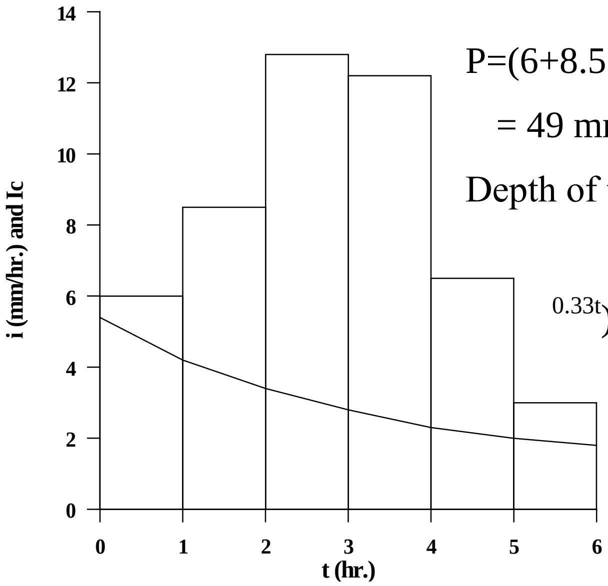
2- Compute Φ-Index & W- index and choose the best from them and explain cause that

t(hr.)	1	2	3	4	5	6
Rainfall(mm)	6	8.5	12.8	12.2	6.5	3

t(hr.)	**I_c**
0	5.4
1	4.2
2	3.4
3	2.8
4	2.3
5	2

Solution:

6	1.8



P=(6+8.5+12.8+12.2+6.5+3)

= 49 mm

Depth of the infiltration =∫y dt

$=(1.2+4.2\, e^{-0.33t})dt$

$= 1.2t-(4.2/0.33)e^{-0.33t}]$

$=[1.2*6-(4.2/0.33)*e^{-0.33*6}]-[1.2*0 -(4.2/0.33) *e^{-0.33*0}]$

= 18.19mm

R=P-I

=49-18.19

=30.81mm

W-index=(P-R)/t

=18.19/6

=3.032 mm/hr.

To Find The **Φ-Index:**

R=30.81 mm

30.81=(12.8-12.2)*1+(12.2-8.5)*2+(8.5-6.5)*3+(6.5-6)*4+(6- **Φ)**

30.81=16+6*5-5* Φ

Φ=3.038 mm/hr.

We choose the w-index because it gives larger surface runoff.

Example:

A catchment soil has the following Horton infiltration Parameters:

f_0 = 100 mm/min, f_c = 20 mm/min, and k = 2 min^{-1} the required.

1- Plot the infiltration capacity curve with time for this catchment

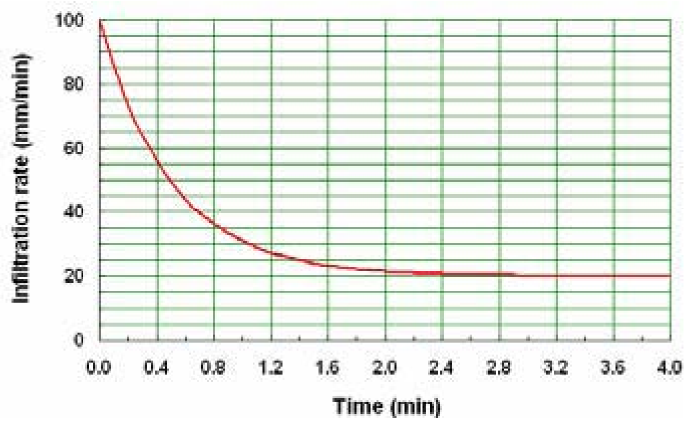
2- Plot the potential cumulative infiltration for this catchment

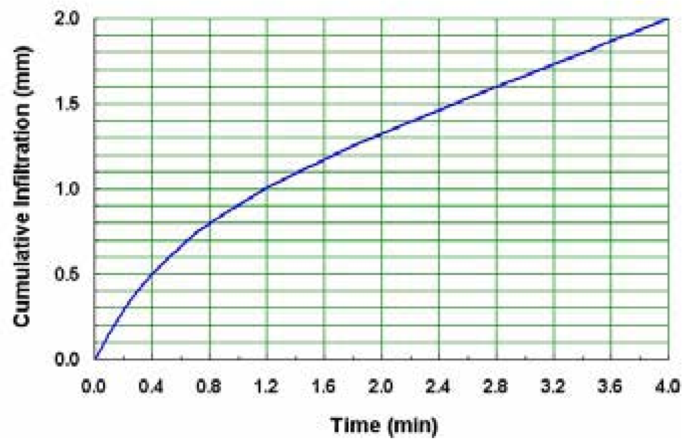
Solution:

$f(t) = f_c + (f_o - f_c)\, e^{-Kt}$ (Horton equ.)

$F(t) = f_c\, t + \frac{(f_o - f_c)(1 - e^{-Kt})}{K}$ (cumulative infiltration rate)

t (min)	f_p (mm/min)	F (mm)
0.0	100.00	0.00
0.2	73.63	0.29
0.4	55.95	0.50
0.6	44.10	0.67
0.8	36.15	0.80
1.0	30.83	0.91
1.2	27.26	1.01
1.4	24.86	1.09
1.6	23.26	1.17
1.8	22.19	1.25
2.0	21.47	1.32
2.2	20.98	1.39
2.4	20.66	1.46
2.6	20.44	1.53
2.8	20.30	1.60
3.0	20.20	1.67
3.2	20.13	1.73
3.4	20.09	1.80
3.6	20.06	1.87
3.8	20.04	1.93
4.0	20.03	2.00
4.2	20.02	2.07





Example:

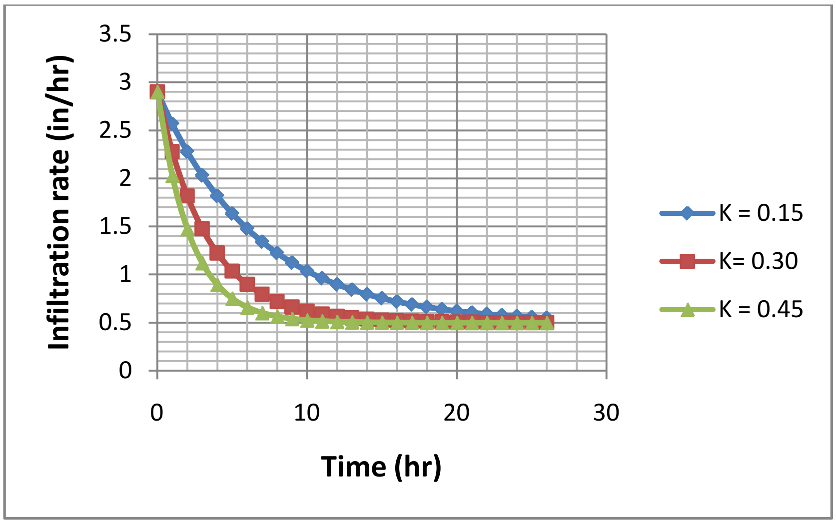
□ Find out the sensitivity of the infiltration capacity curve to different decay coefficients (k) assuming that f_0 = 2.9 in/h and f_c = 0.5 in/h

□ Assume k values = 0.15, 0.30, and 0.45 hour $^{-1}$

Solution:

$$f(t) = f_c + (f_o - f_c)\, e^{-Kt} \quad \text{(Horton equ.)}$$

t (hr)	f_p(in/hr)	f_p(in/hr)	f_p(in/hr)
	K= 0.15	K= 0.30	K= 0.45
0	2.9	2.9	2.9
1	2.6	2.3	2
2	2.3	1.8	1.5
3	2	1.5	1.1
4	1.8	1.2	0.9
5	1.6	1	0.8
6	1.5	0.9	0.7
7	1.3	0.8	0.6
8	1.2	0.7	0.6
9	1.1	0.7	0.5
10	1	0.6	0.5
11	1	0.6	0.5
12	0.9	0.6	0.5
13	0.8	0.5	0.5
14	0.8	0.5	0.5
15	0.8	0.5	0.5
16	0.7	0.5	0.5
17	0.7	0.5	0.5
18	0.7	0.5	0.5
19	0.6	0.5	0.5
20	0.6	0.5	0.5
21	0.6	0.5	0.5
22	0.6	0.5	0.5
23	0.6	0.5	0.5
24	0.6	0.5	0.5
25	0.6	0.5	0.5
26	0.5	0.5	0.5


Infiltration rate (in/hr)
3.5
3
2.5
2
1.5
1
0.5
0
0
10
20
30
Time (hr)
K = 0.15
K= 0.30
K = 0.45