

Z-Transform			
I. Find Z-Transform and its ROC of the following sequences			
DIV-A	DIV-B	Questions	Answers with ROC
1	64	$f(k) = 3^k, k \geq 0$	$1/[1-(3/z)]; z > 3$
2	65	$f(k) = (1/6)^k, k \geq 0$	$1/[1-(1/6z)]; z > \frac{1}{6}$
3	66	$f(k) = 2, k \geq 0$	$2/[1-(1/z)]; z > 1$
4	67	$f(k) = (1/3)^k, k < 0$	$3z/[1-(3z)]; z < \frac{1}{3}$
5	68	$f(k) = \begin{cases} 3^k, & k < 0 \\ 2^k, & k \geq 0 \end{cases}$	$\frac{2z}{[(3-z)(z-2)]}; 2 < z < 3$
6	69	$f(k) = \begin{cases} 4^k, & k < 0 \\ 3^k, & k \geq 0 \end{cases}$	$\frac{3z}{[(4-z)(z-3)]}; 3 < z < 4$
7	70	$f(k) = \begin{cases} a^k, & k < 0 \\ b^k, & k \geq 0 \end{cases}, a, b > 0, a > b$	$\frac{(a-b)z}{[(a-z)(z-b)]}; b < z < a$
8	71	$f(k) = k3^k, k \geq 0$	$3z/(z-3)^2; z > 3$
9	72	$f(k) = ka^k, k \geq 0, a > 0$	$az/(z-a)^2; z > a$
10	73	$f(k) = 3^k/k, k > 1$	$-\log\left(1 - \frac{3}{z}\right); z > 3$
11	74	$f(k) = a^k/k, k > 1, a > 0$	$-\log\left(1 - \frac{a}{z}\right); z > a$
12	75	$f(k) = (1/2)^{ k }, \text{ for all } k$	$\frac{1}{2} \cdot \frac{z}{1-(z/2)} + \frac{1}{1-2z}; \frac{1}{2} < z < 2$
13	76	$f(k) = (1/4)^{ k }, \text{ for all } k$	$\frac{1}{4} \cdot \frac{z}{1-(z/4)} + \frac{1}{1-1/4z}; \frac{1}{4} < z < 4$
14	77	$f(k) = a^k, \text{ for all } k, 0 < a < 1$	$\frac{az}{1-az} + \frac{1}{1-(a/z)}; a < z < \frac{1}{ a }$
15	78	$f(k) = \left(\frac{3^k}{k!}\right), k \geq 0$	$e^{3/z}, \text{ ROC } z\text{-plane}$
16	79	$f(k) = \left(\frac{5^k}{k!}\right), k \geq 0$	$e^{5/z}, \text{ ROC } z\text{-plane}$
17	80	$f(k) = e^{ka}, k \geq 0$	$(1 - \frac{e^a}{z})^{-1}; z > e^a $
18	81	$f(k) = \begin{cases} 2^k, & k \leq -1 \dots \\ (1/2)^k, & k = 0, 2, 4, \dots \\ (1/3)^k, & k = 1, 3, 5, \dots \end{cases}$	$\frac{2}{2-z} + \frac{4z^2}{4z^2-1} + \frac{3z}{9z^2-1}; \frac{1}{2} < z < 2$
19	82	$f(k) = \begin{cases} a^k, & k \leq -1 \dots \\ (1/b)^k, & k = 0, 2, 4, \dots \\ (1/c)^k, & k = 1, 3, 5, \dots \end{cases}$	
20	83	$f(k) = \begin{cases} (1/3)^k, & k \leq -1 \dots \\ 0, & k = 0 \\ (1/2)^k, & k \geq 1 \end{cases}$	
II. Properties of Z-Transform			
21	84	$f(k) = 2^{ k }, k \geq 0$	$\frac{3z}{[(1-2z)(2z-1)]}$
22	85	$f(k) = (1/2)^k, k \geq 0$	$\frac{3z}{[(2-z)(z-2)]}$

23	86	$f(k) = \cos k, k \geq 0$	$\frac{z(z - \cos 1)}{z^2 - 2z \cos 1 + 1}$
24	87	$f(k) = \cos 2k, k \geq 0$	$\frac{z(z - \cos 2)}{z^2 - 2z \cos 2 + 1}$
25	88	$f(k) = \sin k, k \geq 0$	$\frac{z \sin 1}{z^2 - 2z \cos 1 + 1}$
26	89	$f(k) = \sin 2k, k \geq 0$	$\frac{z \sin 2}{z^2 - 2z \cos 2 + 1}$
27	90	$f(k) = \cosh k, k \geq 0$	$\frac{z(z - \cosh 1)}{z^2 - 2z \cosh 1 + 1}$
28	91	$f(k) = \cosh 2k, k \geq 0$	$\frac{z(z - \cosh 2)}{z^2 - 2z \cosh 2 + 1}$
29	92	$f(k) = \sinh k, k \geq 0$	$\frac{z \sinh 1}{z^2 - 2z \cosh 1 + 1}$
30	93	$f(k) = \sinh 2k, k \geq 0$	$\frac{z \sinh 2}{z^2 - 2z \cosh 2 + 1}$
31	94	$f(k) = \sin(k+1), k \geq 0$	$\frac{z^2 \sin 1}{z^2 - 2z \cos 1 + 1}$
32	95	$f(k) = 2^k \cos k, k \geq 0$	$\frac{z^2 - 2z \cos 1}{z^2 - 4z \cos 1 + 4}$
33	96	$f(k) = \cos(3k+2), k \geq 0$	$\frac{z(z \cos 2 - \cos 1)}{z^2 - 2z \cos 3 + 1}$
34	97	$f(k) = \sin(3k+2), k \geq 0$	$\frac{z(\sin 1 + z \sin 2)}{z^2 - 2z \cos 3 + 1}$
35	98	$f(k) = \sin(ak + \frac{\pi}{2}), k \geq 0$	$\frac{z(z - \cos a)}{z^2 - 2z \cos a + 1}$
36	99	$f(k) = \cos(ak + \frac{\pi}{2}), k \geq 0$	$\frac{-z \cos a}{z^2 - 2z \cos a + 1}$
37	100	$f(k) = \sin(a + \frac{k\pi}{4}), k \geq 0$	$\frac{z \sin \left[\left(\frac{\pi}{4} \right) - a \right] + z \sin a}{z^2 - \sqrt{2}z + 1}$
38	101	$f(k) = \left\{ \frac{1}{k(k+1)} \right\}, k > 0$	$(z-1) \log \left(\frac{z-1}{z} \right)$
39	102	$f(k) = (k+1)^2, k \geq 0$	$\frac{z^2(2z+1)}{(z-1)^3}$
40	103	$f(k) = (2k+5)^2, k \geq 0$	
41	104	$f(k) = 2^k(k+1)^2, k \geq 0$	
42	105	$f(k) = e^{-5k} \cos(ak + \frac{\pi}{2}), k \geq 0$	
43	106	$f(k) = k^2 4^k, k \geq 0$	
44	107	$f(k) = (1/2)^k * (1/4)^k, k \geq 0$	
45	108	$f(k) * g(k)$ where $f(k) = \sin 2k, g(k) = k^2, k \geq 0$	
46	109	$f(k) = c^k$ using $Z\{1\}, k \geq 0$	

47	110	$f(k) = k^3$ using $Z\{1\}$, $k \geq 0$	
48	111	$f(k) = c^k$ and hence for c^{k-1}, c^{k+1}	
49	112	$f(k) = \sin k$, $k \geq 0$ & hence $\sin(k+1)$	
50	113	$f(k) = \sin 2k \cos 2k$, $k \geq 0$	
III. Find Inverse Z-Transform of the following sequences			
51	114	$\frac{1}{z-1}$, $ z < 1$, $ z > 1$	$-1, k \leq 0; 1, k \geq 1$
52	115	$\frac{z}{z-1}$, $ z < 1$, $ z > 1$	$-1, k < 0; 1, k \geq 0$
53	116	$\frac{1}{z-3}$, $ z < 3$, $ z > 3$	$-3^{k-1}, k \leq 0; 3^{k-1}, k \geq 1$
54	117	$\frac{z}{z-a}$, $ z < a$, $ z > a$, $a > 0$	$-a^k, k < 0; a^k, k \geq 0$
55	118	$\frac{1}{(z-1)^2}$, $ z < 1$, $ z > 1$	$-k+1, k \leq 0; (k-1), k \geq 2$
56	119	$\frac{1}{(z-5)^2}$, $ z < 5$, $ z > 5$	$\frac{-k+1}{5^{-k+2}}, k \leq 0; (k-1)5^{k-2}, k \geq 2$
57	120	$\frac{1}{(z-3)^2}$, $ z < 3$, $ z > 3$	$\frac{(-k+1)(-k+2)}{2(3^{-k+3})}, k \leq 0; \frac{(k-2)(k-1)}{2}(3^{k-3}), k \geq 3$
58	121	$\frac{1}{(z-1)^3}$, $ z < 1$, $ z > 1$	
59	122	$\frac{z}{(z-2)(z-3)}$, $ z < 2, 2 < z < 3, z > 3$	
60	123	$\frac{1}{(z-\frac{1}{2})(z-1/3)}$, $\frac{1}{3} < z < \frac{1}{2}, z > 1/2$	
61	124	$\frac{z^3}{(z-1)(z-2)^2}$, $ z > 2$	
62	125	$\frac{z^3}{(z-1)(z-2)^2}$, $ z > 3$	
63	126	$\frac{1}{(z-5)^2}$, $ z < 5$, $ z > 5$	
D1	127, D7	$\frac{z}{(z-1)(z-3)}$, $ z < 1, 1 < z < 3$	
D2	128, D8	$\frac{1}{(z-2)^3}$, $ z < 2$, $ z > 2$	
D3	D9	$\frac{2z^2+3z}{z^2-z+1}$, $ z > 1$	$\frac{8}{\sqrt{3}} \sin \frac{\pi k}{3} + 2 \cos \frac{\pi k}{3}, k \geq 0$
D4	D10	$\frac{2z^2+3z}{z^2+z+1/9}$, $ z > \frac{1}{3}$	$2(-1/3)^k \cos h ak - \frac{12}{\sqrt{5}}(-1/3)^k \sin h ak, k \geq 0$
D5	D11	$\frac{2z^2+3z}{z^2+z+1/16}$, $ z > 2+\sqrt{3}$	$2(-1/4)^k \cos h ak - \frac{16}{\sqrt{3}}(-1/4)^k \sin h ak, k \geq 0$
D6	D12	$\frac{z^2+z}{z^2+z+1}$, $ z > 1$	$\frac{1}{\sqrt{3}} \sin \frac{2\pi k}{3} + \cos \frac{2\pi k}{3}, k \geq 0$