20. Two dice are thrown simultaneously. What is the probability that the sum of the numbers appearing on the dice is (i) 7? (ii) a prime number? (iii) 1?

Solution: When one die shows '1', the other die could show any one of the numbers 1,2,3,4,5,6. The same is true when the first die shows '2', '3', '4', '5' or '6'. The possible outcomes of the experiment are listed below; the first number in each ordered pair is the number appearing on the first die and the second number is that on the other die.

	1	2	3	4	5	6
1	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
2	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
3	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
4	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
5	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
6	(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

So, the number of possible outcomes $= 6 \times 6 = 36$

(i) The outcomes favourable to the event 'the sum of the two numbers is 7' denoted by E are: (1,6), (2,5), (3,4), (4,3), (5,2), (6,1) (see figure above)
i.e., the number of favourable outcomes to E = 5. Hence,

$$P(E) = \frac{6}{36} \tag{1}$$

$$= \frac{1}{6} \tag{2}$$

(ii) As you can see from figure above, the outcomes of the event F, 'the sum of the two numbers is a prime number' are: (1,1), (1,2), (1,4), (1,6), (2,1), (2,3), (2,5), (3,2), (3,4), (4,1), (4,3), (5,2), (5,6), (6,1), (6,5)
i.e., the number of favourable outcomes to F = 15
So,

$$P(F) = \frac{15}{36} \tag{3}$$

$$= \frac{5}{12} \tag{4}$$

(iii) As you can see from figure above, there is no outcome favourable to the event G, 'the sum of two numbers is 1'.
So,

$$P(G) = \frac{0}{36} \tag{5}$$

$$= 0 \tag{6}$$