EXERCISE 23.3

Find the equation of a line making an angle of 150° with the x–axis and cutting off an intercept 2 from y–axis.
Solution:
Given: A line which makes an angle of 150° with the x–axis and cutting off an intercept at 2
By using the formula,
The equation of a line is $y = mx + c$
We know that angle, $\theta = 150^\circ$
The slope of the line, $m = \tan \theta$
Where, $m = \tan 150^\circ$
$= -1/\sqrt{3}$

Coordinate of y–intercept is (0, 2)
The required equation of the line is $y = mx + c$
Now substitute the values, we get
$y = -x/\sqrt{3} + 2$
$\sqrt{3}y - 2\sqrt{3} + x = 0$
$x + \sqrt{3}y = 2\sqrt{3}$
∴ The equation of line is $x + \sqrt{3}y = 2\sqrt{3}$

1. Find the equation of a straight line:
(i) with slope 2 and y – intercept 3;
(ii) with slope – 1/ 3 and y – intercept – 4.
(iii) with slope – 2 and intersecting the x–axis at a distance of 3 units to the left of origin.
Solution:
(i) With slope 2 and y – intercept 3
The slope is 2 and the coordinates are (0, 3)
Now, the required equation of line is
$y = mx + c$
Substitute the values, we get
$y = 2x + 3$

(ii) With slope – 1/ 3 and y – intercept – 4
The slope is – 1/3 and the coordinates are (0, – 4)
Now, the required equation of line is
$y = mx + c$

Substitute the values, we get
$y = -1/3x – 4$
$3y + x = – 12$

(iii) With slope – 2 and intersecting the x–axis at a distance of 3 units to the left of origin
The slope is – 2 and the coordinates are (– 3, 0)
Now, the required equation of line is $y – y_1 = m (x – x_1)$
Substitute the values, we get
$y – 0 = – 2(x + 3)$
$y = – 2x – 6$
$2x + y + 6 = 0$

2. Find the equations of the bisectors of the angles between the coordinate axes.
Solution:
There are two bisectors of the coordinate axes.
Their inclinations with the positive x-axis are 45^o and 135^o
The slope of the bisector is $m = \tan 45^o$ or $m = \tan 135^o$
i.e., $m = 1$ or $m = -1$, $c = 0$
By using the formula, $y = mx + c$
Now, substitute the values of m and c, we get
$y = x + 0$
$x – y = 0$ or $y = -x + 0$
$x + y = 0$
∴ The equation of the bisector is $x \pm y = 0$

3. Find the equation of a line which makes an angle of $\tan^{-1}(3)$ with the x–axis and cuts off an intercept of 4 units on the negative direction of y–axis.
Solution:
Given:
The equation which makes an angle of $\tan^{-1}(3)$ with the x–axis and cuts off an intercept of 4 units on the negative direction of y–axis
By using the formula,
The equation of the line is $y = mx + c$
Here, angle $\theta = \tan^{-1}(3)$
So, $\tan \theta = 3$
The slope of the line is, $m = 3$
And, Intercept in the negative direction of y–axis is (0, -4)
The required equation of the line is $y = mx + c$
Now, substitute the values, we get

$y = 3x - 4$
∴ The equation of the line is $y = 3x - 4$.

4. Find the equation of a line that has y – intercept – 4 and is parallel to the line joining (2, –5) and (1, 2).
Solution:
Given:
A line segment joining (2, – 5) and (1, 2) if it cuts off an intercept – 4 from y–axis
By using the formula,
The equation of line is $y = mx + C$
It is given that, $c = -4$
Slope of line joining $(x_1 - x_2)$ and $(y_1 - y_2)$,

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

So, Slope of line joining (2, – 5) and (1, 2),

$$m = \frac{2-(-5)}{1-2} = \frac{7}{-1}$$

$m = -7$
The equation of line is $y = mx + c$
Now, substitute the values, we get
$y = -7x - 4$
$y + 7x + 4 = 0$
∴ The equation of line is $y + 7x + 4 = 0$.