The functions are called "linear" because they are precisely the functions whose graph in the xy-plane is a straight line.

Such a function can be written as

1) Slope-intercept form
   $f(x) = mx + b$, where m is the slope and b is the y-intercept.

2) Point-slope form
   $y - y_1 = m(x - x_1)$, where (x_1, y_1) is the known point on the line.
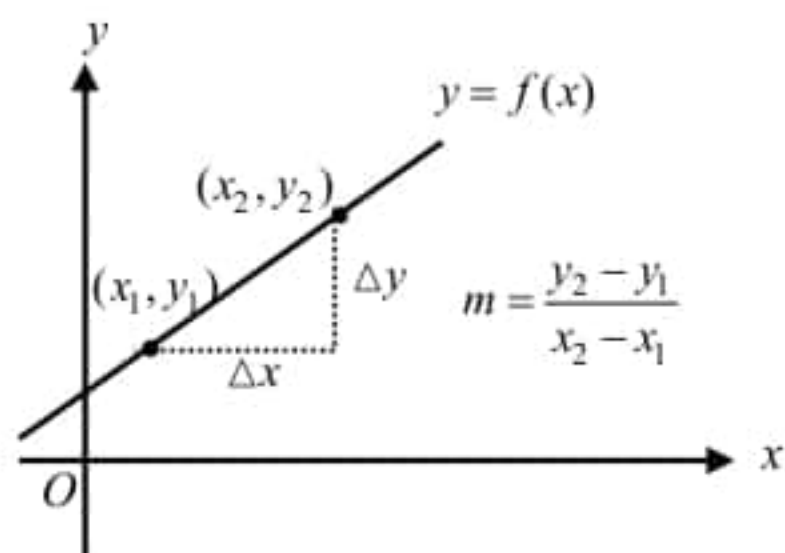
3) General form
   $ax + by + c = 0$

4) Standard form
   $ax + by = c$

Note: The slope between any two points on the line is **constant**.

$$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{f(x_2) - f(x_1)}{x_2 - x_1}, \quad [y_2 = f(x_2), \ y_1 = f(x_1)]$$

Note:
Notation of a point:
1) x and y coordinates: $P(x, y)$
2) $P(x, f(x))$
3) $f(x) = y$

Example:
$f(-3) = 5$ means a point $(-3, 5)$.

SAT Practice

1. For a linear function f, $f(0) = 2$ and $f(3) = 5$. If $k = f(5)$, what is the value of k?
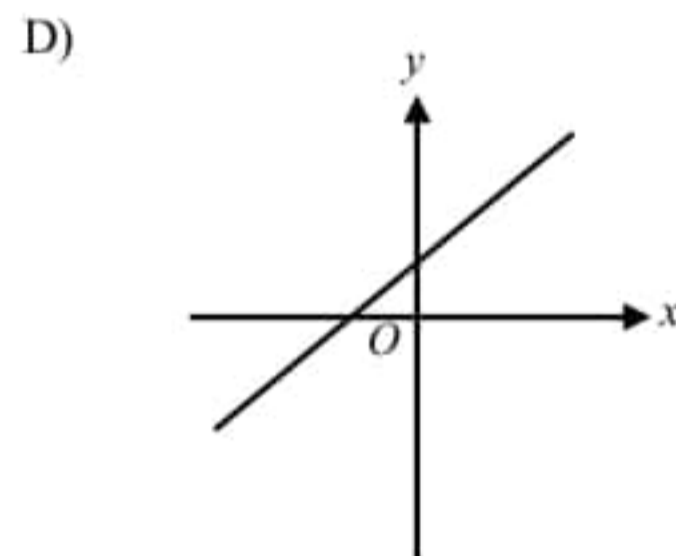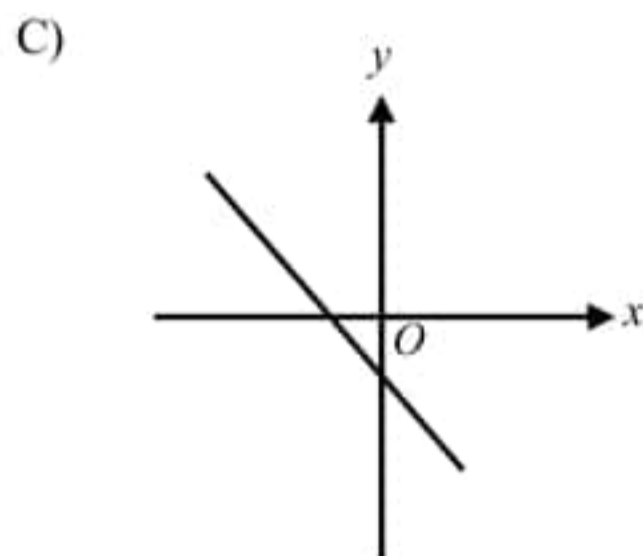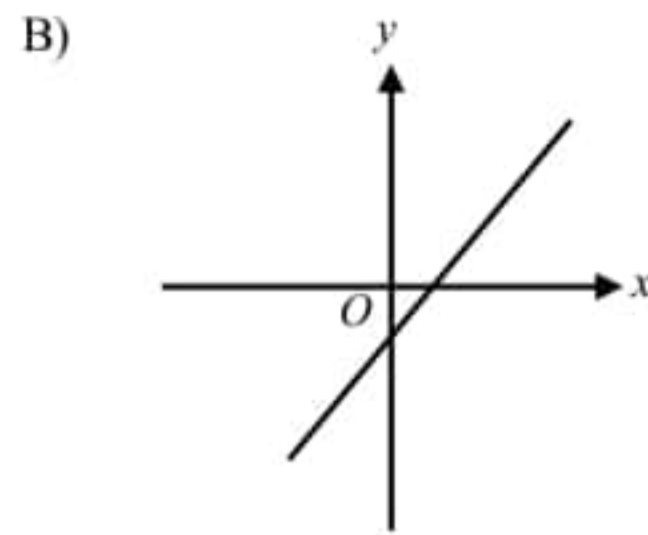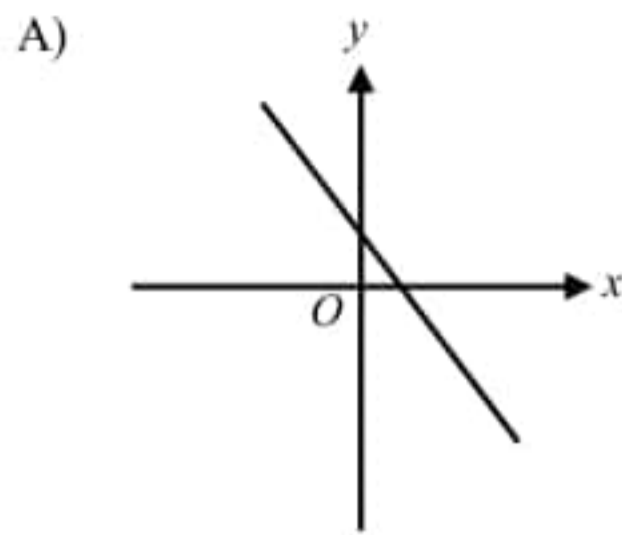
   A) 5
   B) 6
   C) 7
   D) 8

x	$f(x)$
0	a
1	12
2	b

2. The table above shows some values for the function f. If f is a linear function, what is the value of $a + b$?
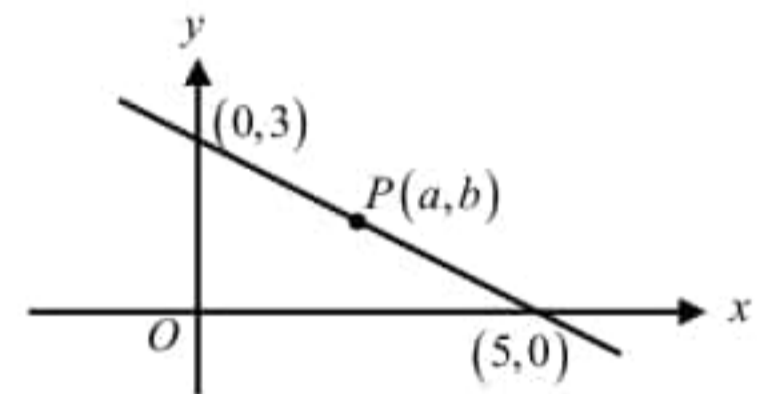
   A) 24
   B) 36
   C) 48
   D) 60

3. A linear function is given by $ax+by+c=0$ and $a>0$, $b<0$, and $c>0$. Which of the following graphs best represents the graph of the function?

A)

B)

C)

D)

4. If f is a linear function and $f(3)=2$ and $f(5)=6$, what is the y-intercept of the graph of f?

A) 4
B) 2
C) –2
D) –4

6. The graph of a function f is shown in the xy-plane above. If $b=2a$, what is the value of a?

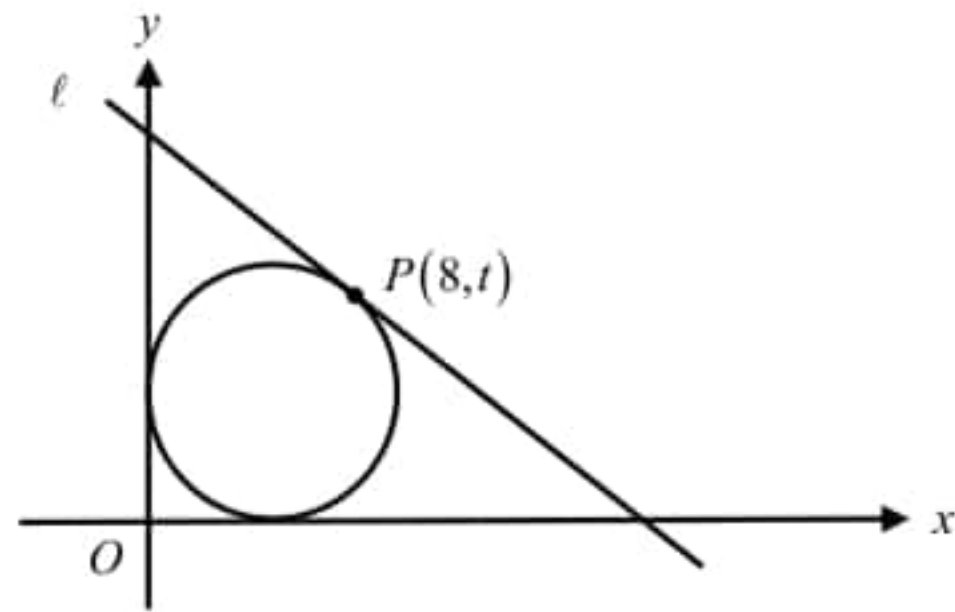A) $\dfrac{5}{2}$ B) $\dfrac{5}{4}$ C) $\dfrac{15}{13}$ D) $\dfrac{16}{15}$

5. If f is a linear function and $f(3)=-2$ and $f(4)=-4$, what is the x-intercept of the graph of f?

A) 3
B) 2.5
C) 2
D) 0

x	$f(x)$
-1	6
0	4
1	2
2	0

7. The table above shows some values of the linear function f for selected values of x. Which of the following represents the function f?

A) $f(x) = 4 - x$

B) $f(x) = 4 - 2x$

C) $f(x) = 4 + 2x$

D) $f(x) = 4 + x$

$$F = \frac{9}{5}C + 32$$

8. Fahrenheit (F) and Celsius (C) are related by the equation above. If Fahrenheit temperature increased by 27 degrees, what is the degree increase in Celsius?
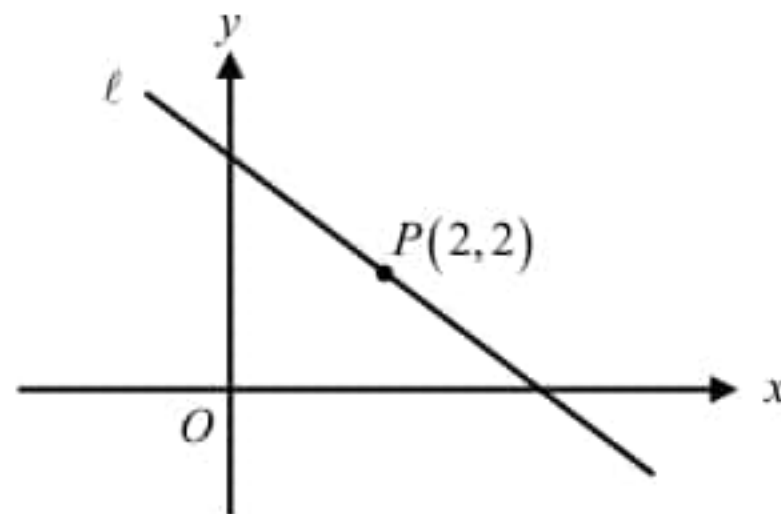
A) 15

B) 20

C) 32

D) 81

9. In the formula $P = \frac{7}{12}K + 60$, if P is increased by 35, what is the increase in K?

A) 35

B) 60

C) 80

D) 140

10. In the xy-plane above, a circle is tangent to line ℓ, the x-axis, and the y-axis. If the radius of the circle is 5, what is the value of t?

A) 7

B) 8

C) 9

D) 10

11. If f is a linear function and $f(3) = 6$ and $f(5) = 12$, what is the slope of the graph of f?

A) 2

B) 3

C) 4

D) 5

12. In the xy-plane above, line ℓ passes through point P and has a slope of $-\frac{1}{2}$. What is the x-intercept of line ℓ?

A) $(4, 0)$ B) $(5, 0)$ C) $(6, 0)$ D) $(7, 0)$

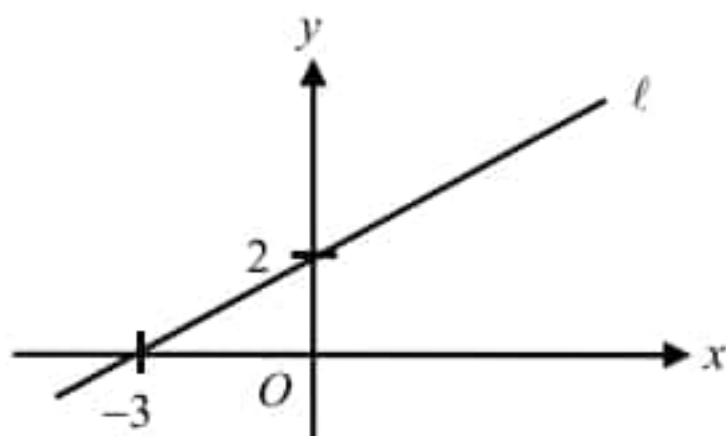| x	$f(x)$
2	5
4	a
8	23
a	b

13. The table above shows values of the linear function f for selected values of x. What is the value of b?

A) 11
B) 22
C) 32
D) 42

x	$f(x)$
2	a
5	6
8	b

14. The table above gives values of the linear function f for selected values of x. What is the value of $a+b$?

A) 8
B) 10
C) 12
D) 18

15. In the xy-plane above, point $P(42, m)$ lies on line ℓ. What is the value of m?

A) 24
B) 30
C) 36
D) 42