

**Question 1:**

Answer the following True/False questions,

1. The two fundamental properties of sets are,

- Duplicate elements are not allowed.
- Order matters.

Answer:    **False,**    The order does not matter.

2. Let  $S = \{3, 4, 5, 2, 1, 3, 0\}$ , then  $(-3 + 4 - 5 + 2 - 1 + 3) \in S$ .

Answer:    **True,**    Observe that  $-3 + 4 - 5 + 2 - 1 + 3 = 0$  and  $0 \in S$ , so its true.

3.  $\sqrt{4} \in \mathbb{Z}$ .

Answer:    **True,**     $\sqrt{4} = 2$  and  $2 \in \mathbb{Z}$ .

4. The vertex of

$$f(x) = 3(x + 4)^2 + 1$$

is  $(4, 1)$ .

Answer:    **False,**    The vertex here is  $(-4, 1)$ .

5. The centre of the circle,

$$(x + 1)^2 + (y + 2)^2 = 4$$

is  $(-1, -2)$ .

Answer:    **True**

6. The vertex of,

$$f(x) = -\frac{5}{3}(x - 3)^2 - 4.$$

represents a minimum.

Answer:    **False,**    Since  $a = -\frac{5}{3} < 0$ , the vertex must represent a maximum.

7. The y-intercept of,

$$f(x) = -x^2 + 3x + 4.$$

is  $-4$ .

Answer:    **False,**    The y-intercept here is 4.

**Question 2:**

Write down the elements of the following sets. (Remember to use dots (...) where applicable)

(a)  $A = \{t \in \mathbb{Z} \mid 0 \leq t < 5\}$

**Solution:**  $A = \{0, 1, 2, 3, 4\}$

(b)  $R = \{r \in \mathbb{Z} \mid r \geq 1\}$

**Solution:**  $R = \{1, 2, 3, 4, 5, \dots\}$

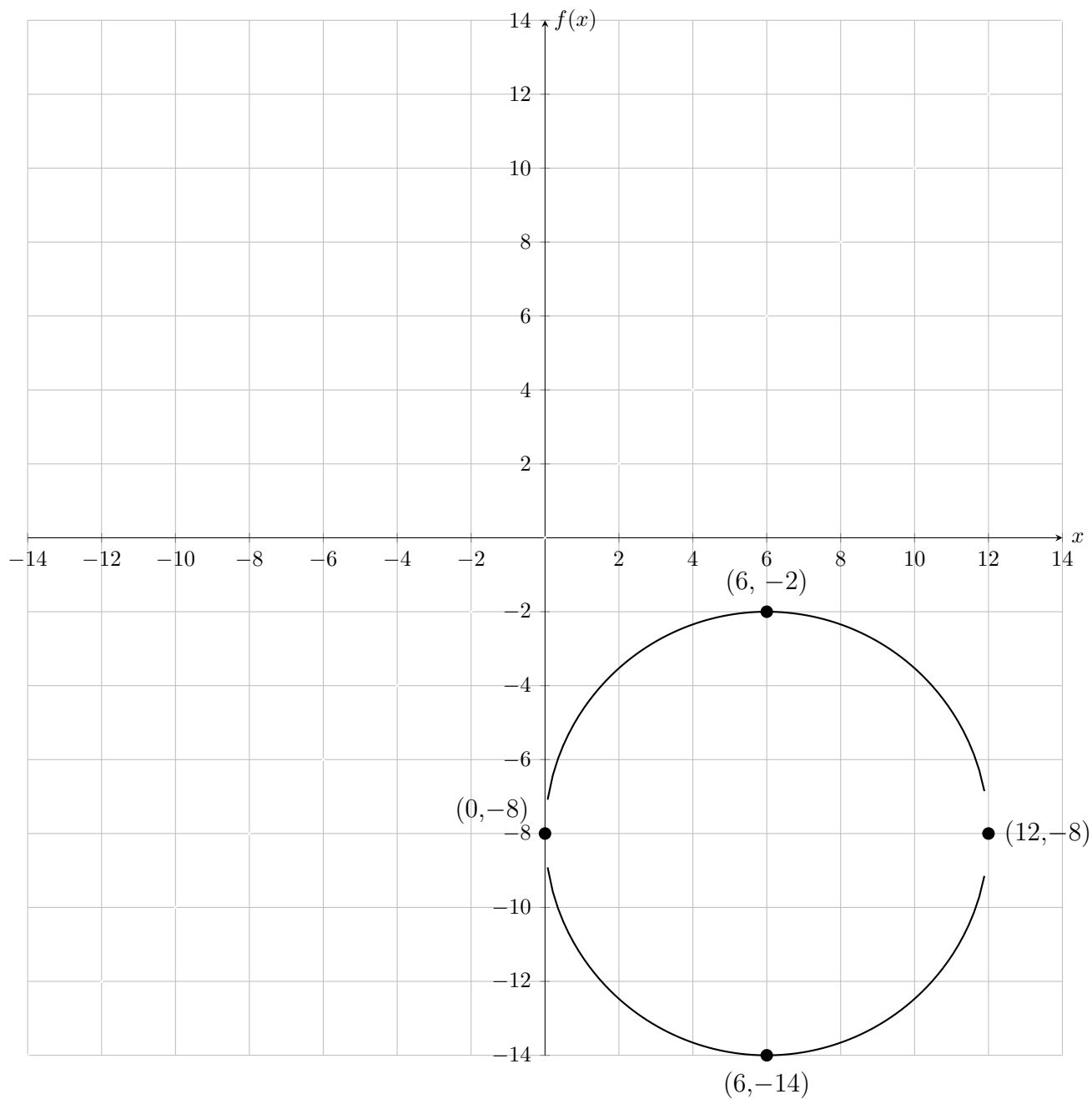
(c)  $T = \{x \in \mathbb{Z} \mid x^2 = 1\}$

**Solution:**  $T = \{-1, 1\}$

**Question 3:**

Graph the following circle,

$$(x - 6)^2 + (y + 8)^2 = 36.$$



**Question 4:**

Lets define the following function,

$$f: \mathbb{R} \rightarrow \mathbb{R}$$

$$f(x) = -x^2 + 2x + 8$$

- (a) Complete the square to convert  $f$  into vertex form.

**Solution:**

**Step 1:**

$$0 = b^2 - 4at$$

$$0 = 4 - 4(-1)(t)$$

$$0 = 4 + 4t$$

$$4t = -4$$

$$t = -1$$

**Step 2:**

$$f(x) = -x^2 + 2x + t - t + 8$$

$$= -x^2 + 2x + (-1) - (-1) + 8$$

$$= (-x^2 + 2x + (-1)) + [8 - (-1)]$$

$$= -\left(x^2 + \frac{2}{-1}x + \frac{(-1)}{-1}\right) + [8 + 1]$$

**Step 3:** Since  $a \cdot b = -1 \cdot 2 = -2$  we conclude that  $a \cdot b < 0$ , so we proceed with the following replacement,

$$f(x) = -\left(x - \sqrt{\frac{t}{a}}\right)^2 + 9$$

$$= -\left(x - \sqrt{\frac{-1}{-1}}\right)^2 + 9$$

$$= -\left(x - \sqrt{\frac{1}{1}}\right)^2 + 9$$

$$= -(x - 1)^2 + 9$$

**Step 4:** Finally, we have  $f$  in vertex form,

$$f(x) = -(x - 1)^2 + 9.$$

(b) Sketch the function using your answer from part (a)

(**NOTE:** Make sure you label the y-intercept as well as the vertex).

