ÜNİTE 11

Unit 11

Özel Tanımlı Fonksiyonlar

Custom Defined Functions

FONKSİYONLARIN TANIM KÜMESİ

DOMAIN SET OF FUNCTIONS

1. $f(x) = \frac{P(x)}{Q(x)}$ ise $Q(x) \neq 0$ (Payda sıfır olamaz.)
(Denaminator cannot be zero.)

Örnek *Example*

- $f(x) = \frac{x-2}{x-3}$ ise $x - 3 \neq 0$

  $x \neq 3$

  Tanım Kümesi = R – {3}
  Domain Set = R – {3}

2. $f(x) = \sqrt[\text{çift}]{g(x)}$ ise $g(x) \geq 0$

$f(x) = \sqrt[\text{tek}]{g(x)}$ ise Tanım Kümesi = R
Domain Set = R

Örnek *Example*

- $f(x) = \sqrt{x-3}$ ise $x - 3 \geq 0$

  $x \geq 3$

  Tanım Kümesi = $[3, \infty)$
  Domain Set = [3, ∞)

Örnek *Example*

- $f(x) = \sqrt[3]{x-2}$ ise kök derecesi = 3 TEK olduğundan,

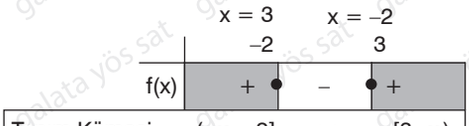
  If f(x) = x – 2 is 3, then root degree = 3

  Tanım Kümesi = R *Domain Set = R*

Örnek *Example*

- $f(x) = \sqrt{x^2 - x - 6}$ ise $x^2 - x - 6 \geq 0$

  -3
  -2
  $x = 3$ $x = -2$



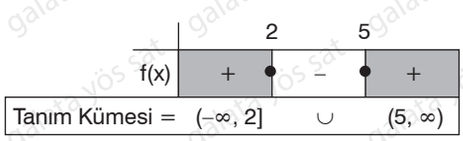
Tanım Kümesi = $(-\infty, -2] \cup [3, \infty)$
Domain Set

Örnek *Example*

- $f(x)$ ise $\sqrt{\frac{x-2}{x-5}}$ ise $\frac{x-2}{x-5} \geq 0$ ve $x - 5 \neq 0$

  $x \neq 5$

  $x = 2$ $x = 5$



Tanım Kümesi = $(-\infty, 2] \cup (5, \infty)$
Domain Set

Örnek *Example*

- $f(x)$ ise $\sqrt[5]{\frac{x-3}{x-2}}$ ise Kök derecesi = 5 TEK
  Degree of root = 5 odd

  Payda $x - 2 \neq 0$
  Denominator x – 2 ≠ 0

  $x \neq 2$

  Tanım Kümesi = R – {2}
  Domain Set

3. 0^0 tanımsızdır. *0^0 is undefined.*

Örnek *Example*

- $f(x) = (x-2)^{x^2-4}$ ise $x = 2$ olduğunda 0^0 olur.

  Tanım Kümesi = R – {2}
  Domain Set = R – {2}

Örnek *Example*

- $f(x) = (x+3)^{x^2-1}$ ise $0°$ olmadığından

  Tanım Kümesi = R
  Domain Set = R

4. $f(x) = \log_{f(x)} g(x)$ ise $g(x) > 0$

$f(x) > 0$

$f(x) \neq 1$

Örnek *Example*

- $f(x) = \log_3 (x-2)$ ise $x - 2 > 0$

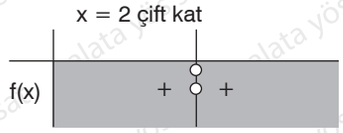
  $x > 2$

  Tanım Kümesi = $(2, \infty)$
  Domain Set = (2, ∞)

Örnek *Example*

- $f(x) = \log_3 (x-2)^2$ ise $(x-2)^2 > 0$

  $x = 2$ çift kat



Tanım Kümesi = $(-\infty, 2) \cup (2, \infty)$
Domain Set
= R – {2}

Örnek *Example*

- $f(x) = 2.\log_3(x-2)$ ise $x - 2 > 0$

  $x > 2$

  Tanım Kümesi = $(2, \infty)$
  Domain Set

Örnek *Example*

- $f(x) = \log_{(x-2)} (7-x)$ ise Tanım Kümesi = ?
  Domain Set = ?

$7 - x > 0$ $x - 2 > 0$ $x - 2 \neq 1$

$7 > x$ $x > 2$ $x \neq 3$

kesişim

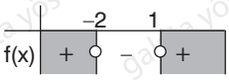
Tanım Kümesi = (2, 7) – {3}
Domain Set = (2, 7) – {3}

Örnek *Example*

- $f(x) = \log_{(x-2)} \left(\frac{x+2}{x-1}\right)$ ise Tanım Kümesi = ?
  Domain Set = ?

$\frac{\overbrace{x+2}^{x=-2}}{\underbrace{x-1}_{x=1}} > 0$ $x - 2 > 0$ $x - 2 \neq 1$

$x > 2$ $x \neq 3$



$(-\infty, -2) \cup (1, \infty)$

kesişim *intersection*

Tanım Kümesi = $(2, \infty) - \{3\}$
Domain Set

Örnek *Example*

- $f(x) = \sqrt{\log_3(x-2)}$ ise

$x - 2 > 0$ $\qquad$ $\log_3(x-2) \geq 0$

$x > 2$ $\qquad$ $x - 2 \geq 3^0$

$x \geq 3$

kesişim *intersection*

$T.K = [3, \infty)$

Sıra Sizde / It is your turn

1. $f(x) = \dfrac{x-2}{x-5}$ ise Tanım Kümesi = ?

2. $f(x) = \dfrac{x+2}{x^2-x-6}$ ise Tanım Kümesi = ?

3. $f(x) = \dfrac{3}{x^2+x+1}$ ise Tanım Kümesi = ?

4. $f(x) = \sqrt[3]{\dfrac{x^2+1}{x^2-1}}$ ise Tanım Kümesi = ?

5. $f(x) = \sqrt{\dfrac{x^2+x+1}{x^2-4}}$ ise Tanım Kümesi = ?

6. $f(x) = \sqrt[4]{x^2-2x-15}$ ise Tanım Kümesi = ?

7. $f(x) = \log(x-7)$ ise Tanım Kümesi = ?

8. $f(x) = \log_5(16-x^2)$ ise Tanım Kümesi = ?

9. $f(x) = \log_{(x-2)}(12-x)$ ise Tanım Kümesi = ?

10. $f(x) = \log_{(x)}(25-x^2)$ ise Tanım Kümesi = ?

11. $f(x) = \sqrt{(-x^2-x+20)}$ ise Tanım Kümesi = ?

12. $f(x) = \sqrt[3]{2-\log x}$ ise Tanım Kümesi = ?

13. $f(x) = \sqrt{x^2-x+5}$ ise Tanım Kümesi = ?

14. $f(x) = \sqrt{\log_{\frac{1}{2}}(x-2)}$ ise Tanım Kümesi = ?

15. $f(x) = \sqrt{\log_{\frac{1}{3}}(x^2-x-12)}$ ise Tanım Kümesi = ?

16. $f(x) = \sqrt{\dfrac{\log(x-2)}{\ln((3-x)}}$ ise Tanım Kümesi = ?

Cevaplar / Answers

1. $R - \{5\}$
2. $R - \{-2, 3\}$
3. R
4. $R - \{-1, 1\}$
5. $(-\infty, -2) \cup (2, \infty)$
6. $(-\infty, -3] \cup [5, \infty)$
7. $(7, \infty)$
8. $(-4, 4)$
9. $(2, 12) - \{3\}$
10. $(0, 5) - \{1\}$
11. $[5, 4]$
12. $(0, 100)$
13. R
14. $(2, 3)$
15. $(-3, 4)$
16. $(2, 3)$

TEK-ÇİFT FONKSİYON *ODD-EVEN FUNCTION*

Çift Fonksiyon *Even Function*

Her $x \in R$ için

$f(-x) = f(x)$ ise **ÇİFT FONKSİYON**'dur.

- Çift fonksiyon y eksenine göre simetriktir.

If $(-x) = f(x)$ for every $x \in R$, then it is EVEN FUNCTION.

• The even function is symmetrical with respect to the y-axis.

UYARI WARNING

- cos x
- $x^{çift}$ *even*
- *constant number* sabit sayı
- |x|

} çift terimlerdir. *even terms.*

Tek Fonksiyon *Odd Function*

Her $x \in R$ için

$f(-x) = -f(x)$ ise **TEK FONKSİYON**'dur.

- Tek fonksiyon orjine göre simetriktir.

If $(-x) = -f(x)$ for every $x \in R$, then it is ODD FUNCTION.

• The odd function is symmetrical with respect to its origin.

UYARI WARNING

- sin x
- tan x
- cot x
- x^{tek}

} tek terimlerdir. *odd terms.*

Not / *Note*

Her terim TEK ise TEK fonksiyondur ya da her terim ÇİFT ise ÇİFT fonksiyondur.
Bir fonksiyonun bazı terimleri tek, bazı terimleri çift ise fonksiyon tek ya da çift değildir.

If each term is ODD it is a ODD function, or if each term is EVEN then it is an EVEN function.

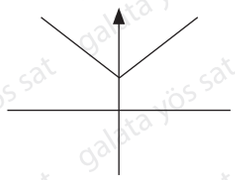
If some terms of a function are odd and some terms are even, the function is not odd or even.

Örnek *Example*

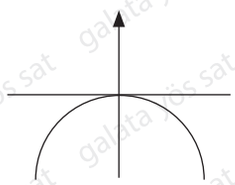
- $f(x) = \underbrace{\cos x}_{çift} + \underbrace{3 \,.\, |x|}_{çift} + \underbrace{2}_{çift} \Rightarrow$ çift fonksiyon *even function*
- $f(x) = x^2 + \sec x + 3 \Rightarrow$ çift fonksiyon *even function*
- $f(x) = x^3 + \tan x + \sin x \Rightarrow$ tek fonksiyon *odd function*
- $f(x) = x^2 + x^3 + 2 \Rightarrow$ tek ya da çift fonksiyon değildir.
  it is not an odd or even function.
- $f(x) = x \,.\, \cos x \Rightarrow f(-x) = -x \cos(-x)$
  $= -x \cos x$

  yani $f(-x) = -f(x) \Rightarrow$ tek fonksiyon *odd function*

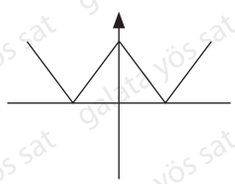
Örnek *Example*



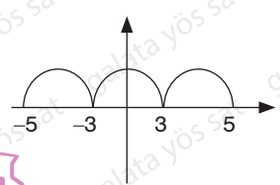
çift fonksiyon *even function*
(y eksenine göre simetrik)
(symmetrical with respect to the y-axis)



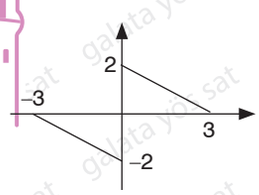
çift fonksiyon
even function



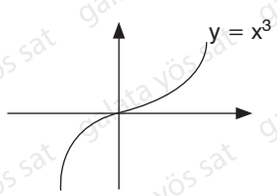
çift fonksiyon
even function



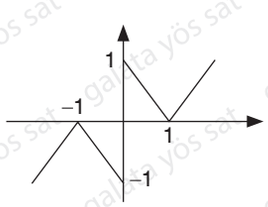
çift fonksiyon
even function



tek fonksiyon *odd function*
(orjine göre simetrik)
(symmetrical with respect to the origin)



tek fonksiyon
odd function



tek fonksiyon
odd function

Örnek *Example*

- **Aşağıdakilerden hangileri y eksenine göre simetriktir?**

Which of the following are symmetrical with respect to the y-axis?

I. $f(x) = x^2 + 3 \rightarrow$ çift fonksiyon *even function*

II. $f(x) = x^3 + 3x \rightarrow$ tek fonksiyon *odd function*

III. $f(x)\ x^2 + 3x - 2 \rightarrow$ tek f. değil, çift f. değil
it is not an odd or even function.

IV. $f(x) = |x| + \cos x + 2 \rightarrow$ çift f. *even function*

V. $f(x) = -2x^2 - 2\cos x + 3 \rightarrow$ çift f. *even function*

soruda çift fonksiyon soruluyor. (I, IV, V)
The even function is asked in the question.

Örnek *Example*

- **Aşağıdakilerden hangileri orjine göre simetriktir?**

Which of the following are symmetrical with respect to the origin?

I. $f(x) = x^3 + x \rightarrow$ tek fonksiyon *odd function*

II. $f(x) = x^2 + x \rightarrow$ tek değil, çift değil
not an odd function, not an even function.

III. $f(x) = 2\tan x + x \rightarrow$ tek fonksiyon *odd function*

IV. $f(x) = x^4 + \cos x \rightarrow$ çift fonksiyon *even function*

V. $f(x) = x^3 + 1 \rightarrow$ tek değil, çift değil
not an odd function, not an even function.

soruda tek f. soruluyor. (I, III)
The odd function is asked in the question.

Örnek *Example*

- $f(x) = (m - 2)x^2 + mx + m + n$

f(–x) = –f(x) ise m.n = ?

Tek F. soruluyor. Çift terim olamaz.
The odd function is asked, no even term.

$m - 2 = 0$ | $m + n = 0$ | $m \cdot n = -4$

$m = 2$ | $2 + n = 0$

$n = -2$

Örnek *Example*

- $f(x) = (a - 2)x^2 + ax + a + 3$

f(–x) = f(x) ise a + f(a) = ?

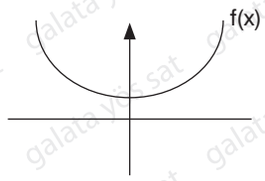
Çift F. soruluyor. Tek terim olamaz.
The even function is asked, no odd term.

$a = 0$ | $a + f(a)$

$f(x) = -2x^2 + 3$ | $a + f(0)$

$f(a) = 3$ | $0 + 3 = 3$

Örnek *Example*

- 

Yukarıdaki f(x) fonksiyonu y eksenine göre simetrik,
The above function f(x) is symmetrical with respect to the y-axis.

$2f(x) + 3f(-x) = 15x^2 + 25$ ise $f(\sqrt{3}) = ?$

f(x) çift fonksiyon f(–x) = f(x)
even function

$2f(x) + 3f(x) = 15x^2 + 25$

$f(x) = 3x^2 + 5$

$f(\sqrt{3}) = 14$

Örnek *Example*

- $[-5, b + 2] \rightarrow$ R tanımlı çift fonksiyonda
Even function, what is f(b) = ?

f(–3) = 7 ise f(b) = ?

çift f olduğundan $b + 2 = 5$
Since it is aneven function

$b = 3$

$f(b) = f(3) = f(-3) = 7$

ARTAN FONKSİYON *INCREASING FUNCTION*

Her x, x_2 için

$x_1 < x_2$ ve $f(x_1) < f(x_2)$ ise artan fonksiyondur.
increasing function.

$x_1 < x_2$ ve $f(x_1) > f(x_2)$ ise azalan fonksiyondur.
decreasing function.

Artan Fonksiyon Grafikleri *Increasing Function Graphics*

Azalan Fonksiyon Grafikleri *Decreasing Function Graphics*

Örnek *Example*

- $f(x) = 3^x + 2 \Rightarrow$ artan fonksiyon *increasing function*
- $f(x) = \log x \Rightarrow$ artan fonksiyon *increasing function*
- $f(x) = \ln(3 - x) \Rightarrow$ azalan fonksiyon *decreasing function*
- $f(x) = 3x + 2 \Rightarrow$ artan fonksiyon *increasing function*
- $f(x) = -2x + 3 \Rightarrow$ azalan fonksiyon *decreasing function*
- $f(x) = 5 \Rightarrow$ sabit fonksiyon *constant function*
- $f(x) = \log_{\frac{1}{2}} x \Rightarrow$ azalan fonksiyon *decreasing function*

Sıra Sizde / It is your turn

Aşağıdakilerden hangisi tek fonksiyon, hangisi çift fonksiyondur?

1. $f(x) = x^2 + 3 + \cos x$

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

3. $f(x) = x^2 . \sin x - x$

4. $f(x) = x^3 . \tan x + 3$

5. $f(x) = x^2 - |x| + 2$

6. $f(x) = x^3 + \sec x + 1$

7. f(x) y eksenine göre simetrik fonksiyondur.

$f(x) = (a-2) . x^3 + ax^2 + 2x^2 + (b-3)x + a + b + 1$

ise $f(5) + a . b = ?$

8. f(x) orjine göre simetrik fonksiyondur.

$f(x) = x^3 + (a-3)x^2 + bx + b + 2$

olduğuna göre $a . b = ?$

9. f(x) fonksiyonu y eksenine göre simetriktir.

$2f(x) + f(-x) = 15x^2 + (a+2)x + 9$

ise $f(a) = ?$

10. f(x) orjine göre simetriktir.

$f, [-3, a] \to R$ ve $f(x) = (a+b)x^2 + bx + c - 2$

ise $a + b + c = ?$

11. I. $2^{\frac{1}{x}} + 2$

II. $\log_3 x$

III. $-3x + 2$

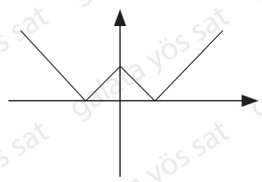
IV. 3

V. $\log_{\frac{1}{3}} (x+2)$

artan – azalan inceleyiniz.

Aşağıdaki grafiklerin tek – çift fonksiyon olup olmadığını inceleyiniz.

12.



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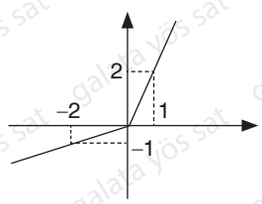

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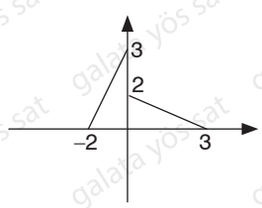

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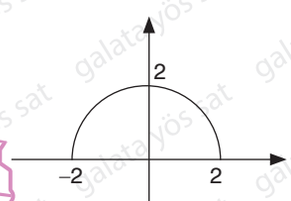

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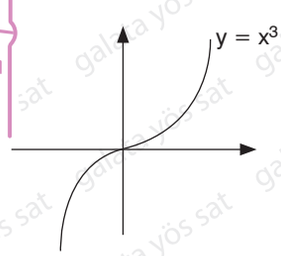


Cevaplar / Answers

1. Çift
2. Tek değil - çift değil
3. Tek fonksiyon
4. Çift fonksiyon
5. Çift fonksiyon
6. Tek değil - çift değil
7. 112
8. –6
9. 23
10. 2
11. I. azalan - II. artan - III. azalan - IV. sabit - V. azalan
12. Çift fonksiyon
13. Tek değil - çift değil
14. Tek değil - çift değil
15. Çift fonksiyon
16. Tek fonksiyon

PARÇALI FONKSİYON *Piecewise Function*

$$f(x) = \begin{cases} x-2 & , \quad x > 3 \\ 5 & , \quad x \le 3 \end{cases}$$

gibi gerçek sayılarının farklı bölgelerinde farklı fonksiyonlar tanımlı ise parçalı fonksiyondur.

If different functions are defined in different parts of real numbers such as f(x), it is apiecewise function.

UYARI WARNING

Kritik Nokta: Parçalanma noktası
Critical Point: Fragmentation point

Örnek *Example*

- $f(x) \begin{cases} 3x+6 & , \quad x < 0 \\ -2x & , \quad x \ge 0 \end{cases}$ Kritik N = 0 *Critical*

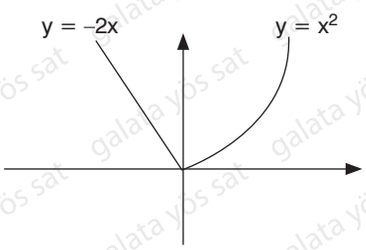
ise $f(2) = -2 \,.\, x = -2 \,.\, 2 = -4$

$f(-3) = 3x + 6 = 3 \,.\, (-3) + 6 = -3$

Örnek *Example*

- $f(x) = \begin{cases} x^2 & , \quad x \ge 0 \\ -2x & , \quad x < 0 \end{cases}$

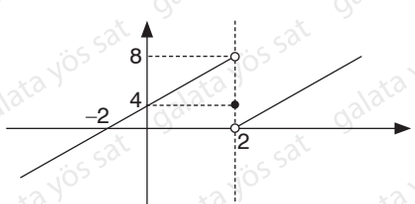
fonksiyonunun grafiği; Kritik N = 0
f(x) function graph *Critical*



Örnek *Example*

- $f(x) \begin{cases} 2x+4 & , \quad x < 2 \\ 4 & , \quad x = 2 \\ 2x-4 & , \quad x > 2 \end{cases}$

fonksiyonunun grafiği; Kritik N = 2
f(x) function graph *Critical*



Örnek *Example*

- $f(x) = \begin{cases} \log x & , \quad x > 1 \\ 3x & , \quad x \le 1 \end{cases}$

ise f(10) + f(–1) = ? **Kritik N = 1** *Critical*

$f(10) = \log x = \log 10 = 1$

$+ \quad f(-1) = 3x = 3 \,.\, (-1) = -3$

$1 + -3 = -2$

Sıra Sizde / It is your turn

1. $f(x) = \begin{cases} x-2 & , \quad x < 0 \\ 3 & , \quad x = 0 \\ x-5 & , \quad 0 < x \le 3 \\ 3-x & , \quad 3 < x \end{cases}$

fonksiyonunun kritik noktaları ?

2. $f(x) = \begin{cases} 3x+6 & , \quad x < 0 \\ x^2+1 & , \quad 0 \le x \end{cases}$

$f(-1) + f(3) = ?$

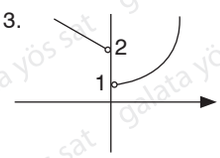
3. $f(x) = \begin{cases} x^2+1 & , \quad x > 0 \\ -x+2 & , \quad x < 0 \end{cases}$

grafiğini çiziniz.

4. $f(x) = \begin{cases} \cos x - \sqrt{3}\tan x & , \quad x > \dfrac{\pi}{4} \\ 2\sin x + 1 & , \quad x \le \dfrac{\pi}{4} \end{cases}$

$\Rightarrow f\left(\dfrac{\pi}{3}\right) + f\left(\dfrac{\pi}{6}\right) = ?$

Cevaplar / Answers

1. {0, 3}
2. 13
3. 

4. $\dfrac{-1}{2}$

MUTLAK DEĞER FONKSİYONU

ABSOLUTE VALUE FUNCTION

$$|f(x)| = \begin{cases} +f(x) & , \ f(x) > 0 \\ 0 & , \ f(x) = 0 \\ -f(x) & , \ f(x) < 0 \end{cases}$$

$|a|$ = a'nın sıfıra uzaklığı *distance of a to zero*

$|f|$ = negatif olamaz. *cannot be negative*

$|f| \geq 0$

Not / *Note*

- $|\underbrace{f(x)}_{+}| = +f(x)$
- $|\underbrace{f(x)}_{-}| = -f(x)$
- $|\underbrace{f(x)}_{0}| = 0$

} işareti ile çarpılır. *is multiplied by the sign.*

UYARI WARNING

Kritik Nokta: Mutlak değer içini sıfır yapan nokta.
Critical Point: The point that makes the absolute value zero inside.

- $|\underbrace{\sqrt{2}-1}_{+}| = (\sqrt{2}-1)$

  $|\underbrace{\sqrt{3}-\pi}_{-}| = -(\sqrt{3}-\pi) = -\sqrt{3}+\pi$

  $|\underbrace{\pi-e}_{+}| = +(\pi-e)$

Örnek *Example*

- $f(x) = \underbrace{|x-2|}_{\substack{x-2=0 \\ x=2 \\ \text{Kritik N}}} = \begin{cases} (x-2) & , \ x > 2 \\ 0 & , \ x = 2 \\ -(x-2) & , \ x < 2 \end{cases}$

Örnek *Example*

- $f(x) = \underbrace{|x^2-4|}_{x^2-4=0}$

  $x = 2$, $x = -2$ } Kritik nokta iki tane *The are 2 critical points*

$$|x^2-4| = \begin{cases} +(x^2-4) & , \ x > 2 \\ 0 & , \ x = 2 \\ -(x^2-4) & , \ -2 < x < 2 \\ 0 & , \ x = -2 \\ +(x^2-4) & , \ x < -2 \end{cases}$$

Not / *Note*

Sıfıra eşit durumunu bir üst ya da bir alta eşit olarak ekleyebiliriz.

$$|x^2-4| = \begin{cases} +(x^2-4) & , \ x \geq 2 \\ -(x^2-4) & , \ -2 < x < 2 \\ +(x^2-4) & , \ x \leq -2 \end{cases}$$

Örnek *Example*

- **$|x-2| = 3$ ise $x = ?$**

$x \geq 2 \Rightarrow x-2 = 3 \Rightarrow x = \boxed{5}$

$x < 2 \Rightarrow -x+2 = 3 \Rightarrow x = \boxed{-1}$

Örnek *Example*

- **$|x-2| + |x| = 4$ ise $x = ?$**

Kritik Nokta Tablosu *Critical Points Table*

$x < 0$	0	$0 < x < 2$	2	$x > 2$
$-x+2-x = 4$		$-x+2+x = 4$		$x-2+x = 4$
$\boxed{x = -1}$		$2 = 4$		$\boxed{x = 3}$
		$\varnothing$		

Ç.K = {–1, 3}
SS

Sıra Sizde / It is your turn

1. $f(x) = |x-3| + |x-1| + x$
ise $f(2) + f(0) = ?$

2. $2 < x < 3$ ise
$|x-2| + |x-3| + |x| = ?$

3. $|x-2| = x-2$
$|x-5| = 5-x$
ise $x = ?$

4. $f(x) = |x-2| + |x-4|$
fonksiyonunu parçalı fonksiyon şekilde yazınız.

5. $f(x) = \dfrac{|x-2| + |x+4|}{|x|}$
fonksiyonunun kritik noktaları?

6. $|x + 2| = 4$ ise $x = ?$

7. $|x - 2| < 3$ ise $x = ?$

8. $|x - 2| + |x + 6| = 8$ ise $x = ?$

Cevaplar / Answers

1. 8 2. $(x + 1)$ 3. $2 \le x \le 5$

4. $f(x) = \begin{cases} 2x - 6 & , x > 4 \\ 2 & , 2 \le x \le 4 \\ -2x + 6 & , x < 2 \end{cases}$ 5. $-4, 0,2$

6. $x = 2$, $x = -6$ 7. $-1 < x < 5$ 8. $-6 \le x \le 2$

Örnek *Example*

- $f(x) = \underbrace{|x - 2|}_{\substack{x-2=0 \\ x=2}} + \underbrace{|x + 2|}_{\substack{x+2=0 \\ x=-2}}$ $\Rightarrow$ Kritik Noktalar *Critical Points*

$$|x - 2| + |x + 2| = \begin{cases} (x - 2) + (x + 2) & , x \ge 2 \\ -(x - 2) + (x + 2) & , -2 < x < 2 \\ -(x - 2) - (x + 2) & , x \le -2 \end{cases}$$

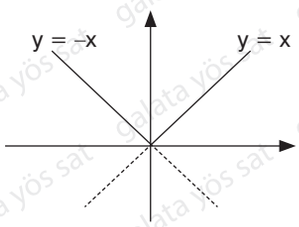
$$= \begin{cases} 2x & , x \ge 0 \\ 4 & , -2 < x < 2 \\ -2x & , x \le -2 \end{cases}$$

Örnek *Example*

- $f(x) = \underbrace{|x|}_{x=0}$ grafiği *f(x) graph*

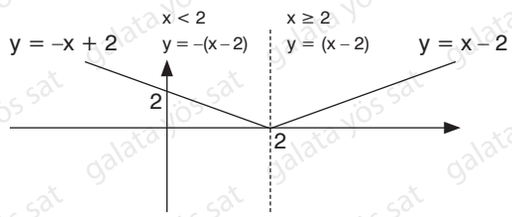
$$= \begin{cases} x & , x \ge 0 \\ -x & , x < 0 \end{cases}$$

Grafiği *The graph*



Örnek *Example*

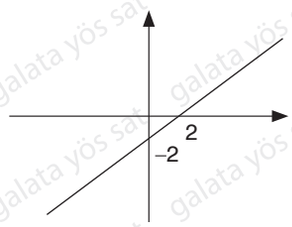
- $f(x) = \underbrace{|x - 2|}_{x=2}$ grafiği *f(x) graph*



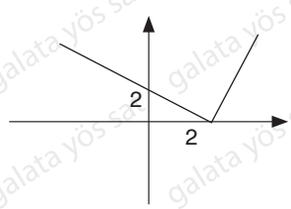
Not / *Note*

Grafikte kısa yol: *Shortcut in graph;*

1. Grafik mutlak değer yokmuş gibi çizilir.
The chart is drawn as if there is no absolute value.

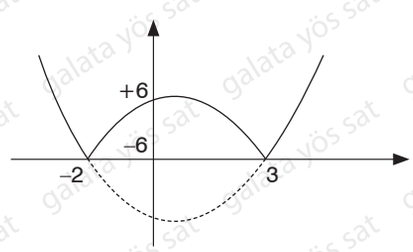


2. Sonra eksenin altında kalan kısım yukarıya simetrik taşınır.
Then the part under the axis is moved up symmetrically.



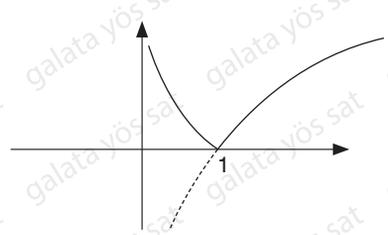
Örnek *Example*

- $f(x) = |x^2 - x - 6|$



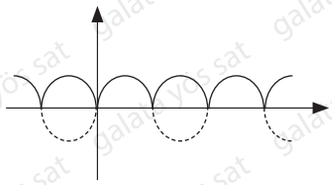
Örnek *Example*

- $f(x) = |\ln x|$



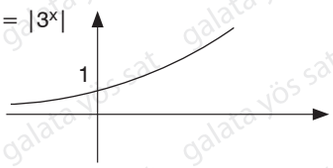
Örnek *Example*

- $f(x) = |\sin x|$



Örnek *Example*

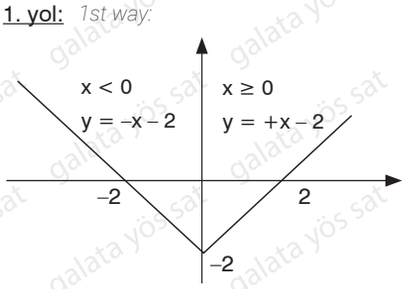
- $f(x) = |3^x|$



Örnek *Example*

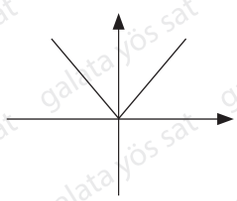
- $f(x) = \underbrace{|x|}_{x=0} - 2$

1. yol: *1st way:*

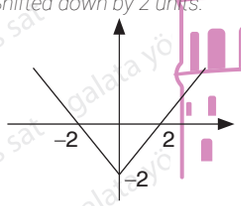


2. yol: *2nd way:*

1. $y = |x|$ çizilir. *y = |x| drawn*



2. $y = |x| - 2$ 2 birim aşağıya ötelenir. *Shifted down by 2 units.*

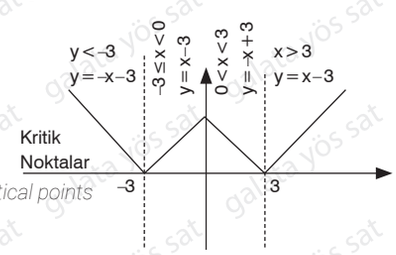


eksenin altındaki kısım yukarı simetrik alınır.
the part under the axis is taken up symmetrically.

Örnek *Example*

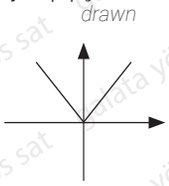
$y = ||x| - 3|$ grafiğini çiziniz. *Draw the graph.*

$||x| - 3|$
$x = 0$
$|x| - 3 = 0 \Rightarrow x = 0$
$|x| = 3 \Rightarrow x = 3$
$x = 3, x = -3 \Rightarrow x = -3$

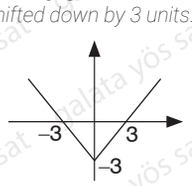


2. yol:
2nd way:

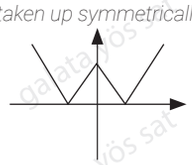
$y = |x|$ çizilir. *drawn*



$y = |x|$ çizilir. *drawn*
3 br. aşağı ötelenir.
Shifted down by 3 units.



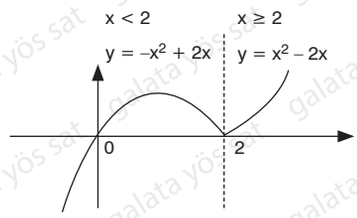
Eksenin altındaki kısım yukarı simetrik alınır.
The part under the axis taken up symmetrically.



Örnek *Example*

- $f(x) = x \cdot \underbrace{|x-2|}_{x=2}$ Kritik N. *Critical points*

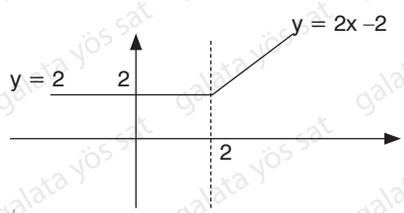
$$= \begin{cases} x^2 - 2x & , \ x \geq 2 \\ -x^2 + 2x & , \ x < 2 \end{cases}$$



Örnek *Example*

- $f(x) = \underbrace{|x-2|}_{x-2=0} + x$
  $x = 2$ Kritik N. *Critical points*

$$f(x) = \begin{cases} (x-2) + x & , \ x \geq 2 \\ -(x-2) + x & , \ x < 2 \end{cases} = \begin{cases} 2x - 2 & , \ x \geq 2 \\ 2 & , \ x < 2 \end{cases}$$

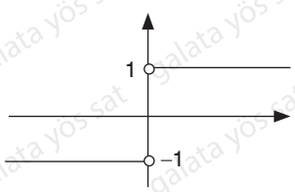


Örnek *Example*

- $f(x) = \dfrac{x}{\underbrace{|x|}_{x=0}}$ Kritik N. *Critical points*

$$f(x) = \begin{cases} \dfrac{x}{+x} & , \ x > 0 \\ \dfrac{x}{-x} & , \ x < 0 \end{cases} = \begin{cases} 1 & , \ x > 0 \\ -1 & , \ x < 0 \end{cases}$$

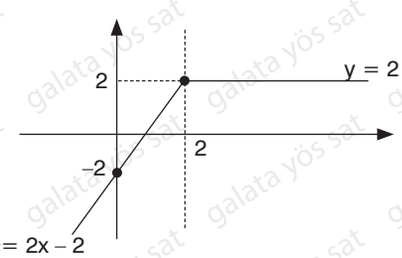
$x = 0$ tanımsızdır. *Undefined*



Örnek *Example*

- $f(x) = x - \underbrace{|x-2|}_{x-2=0}$
  $x = 2$

$$= \begin{cases} x - [+(x-2)] & , \ x \geq 2 \\ x - [-(x-2)] & , \ x < 2 \end{cases} = \begin{cases} 2 & , \ x \geq 2 \\ 2x - 2 & , \ x < 2 \end{cases}$$

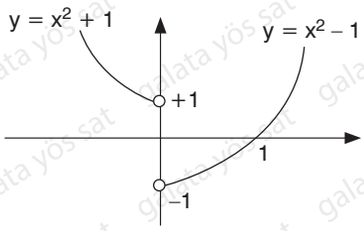


Örnek *Example*

$\underbrace{x = 0}$ Kritik N. *Critical points*

- $f(x) = x^2 - \dfrac{|x|}{x}$

$$= \begin{cases} x^2 - \dfrac{+x}{x} & , \quad x > 0 \\ x^2 - \dfrac{-x}{x} & , \quad x < 0 \end{cases} = \begin{cases} x^2 - 1 & , \quad x > 0 \\ x^2 + 1 & , \quad x < 0 \end{cases}$$

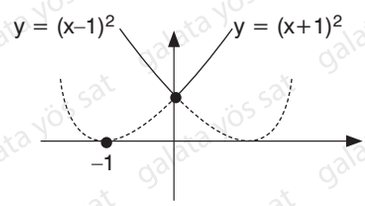


Örnek *Example*

- $f(x) = x^2 + 1 + \underbrace{|2x|}$

$x = 0$ Kritik N. *Critical points*

$$= \begin{cases} x^2 + 1 + 2x & , \quad x \geq 0 \\ x^2 + 1 - 2x & , \quad x < 0 \end{cases} = \begin{cases} (x+1)^2 & , \quad x \geq 0 \\ (x-1)^2 & , \quad x < 0 \end{cases}$$

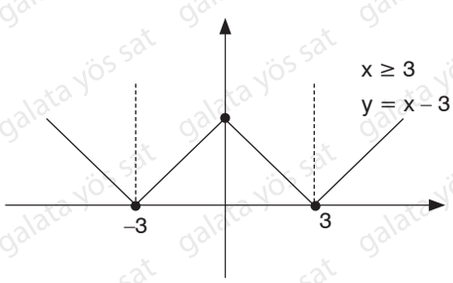


Örnek *Example*

- $f(x) = \dfrac{\underbrace{x = \mp 3}\ |x^2 - 9|}{\underbrace{|x| + 3}\ x = 0}$

$x = 0$
$x = 3$
$x = -3$
Kritik N. *Critical points*

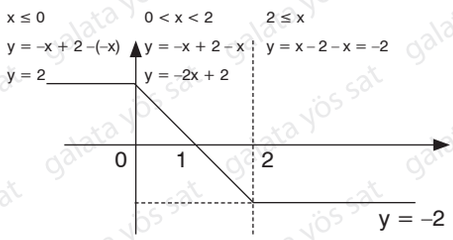
$$= \begin{cases} \dfrac{x^2 - 9}{+x + 3} & , \quad x \geq 3 \Rightarrow y = x - 3 \\ \dfrac{-(x^2 - 9)}{+x + 3} & , \quad 0 \leq x < 3 \Rightarrow y = -x + 3 \\ \dfrac{-(x^2 - 9)}{-x + 3} & , \quad -3 \leq x < 0 \Rightarrow y = x + 3 \\ \dfrac{+(x^2 - 9)}{-x + 3} & , \quad x < -3 \Rightarrow y = -x - 3 \end{cases}$$



Örnek *Example*

- $f(x) = \underbrace{|x-2|} - \underbrace{|x|}$

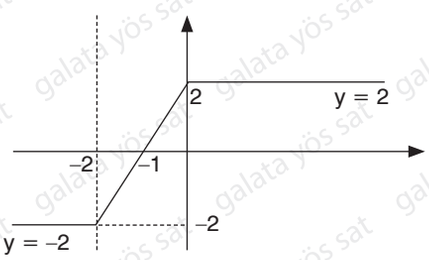
$x = 2$ $x = 0$ Kritik N. *Critical points*



Örnek *Example*

- $f(x) = \underbrace{|x+2|} - \underbrace{|x|}$

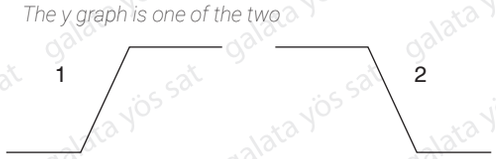
$x = -2$ $x = 0$ Kritik N. *Critical points*



Not / *Note*

$y = |ax + b| - |ax + c|$ grafiği

The y graph is one of the two

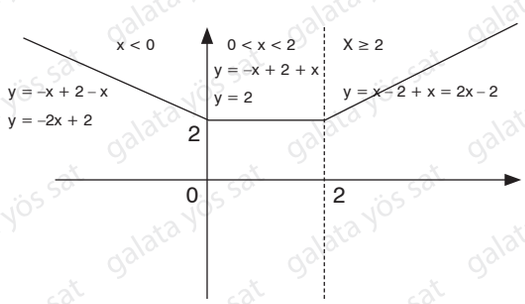


ikisinden birisidir.

Örnek *Example*

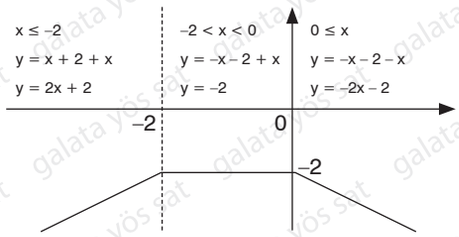
- $f(x) = \underbrace{|x-2|} + \underbrace{|x|}$

$x = 2$ $x = 0$ Kritik N. *Critical points*



Örnek *Example*

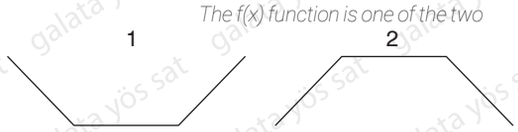
- $f(x) = -\underbrace{|x+2|}_{x=-2} - \underbrace{|x|}_{x=0}$



Not / *Note*

$f(x) = |ax + b| + |ax + c|$ fonksiyonu,

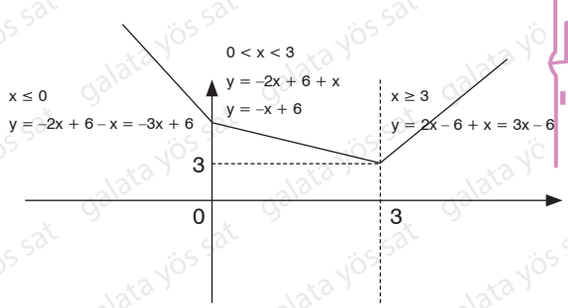
The f(x) function is one of the two



grafiklerinden birisidir.

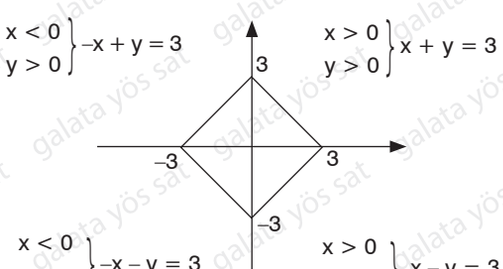
Örnek *Example*

- $f(x) = \underbrace{|2x-6|}_{x=3} + \underbrace{|x|}_{x=0}$



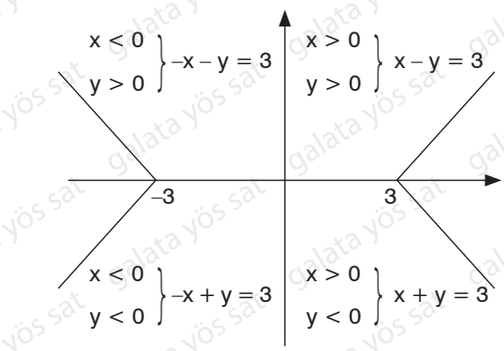
Örnek *Example*

- $\underbrace{|x|}_{x=0} + \underbrace{|y|}_{y=0} = 3$ Kritik N. *Critical points*



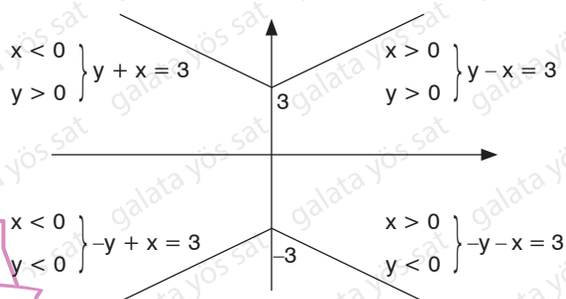
Örnek *Example*

- $\underbrace{|x|}_{x=0} - \underbrace{|y|}_{y=0} = 3$ Kritik N. *Critical points*



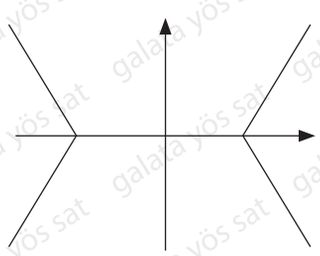
Örnek *Example*

- $\underbrace{|y|}_{y=0} - \underbrace{|x|}_{x=0} = 3$ Kritik N. *Critical points*

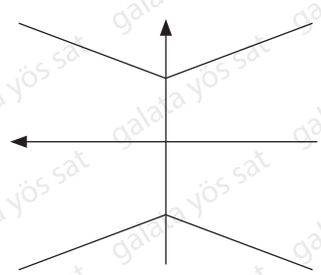


Not / *Note*

1. $|ax| - |by| = c$



1. $|ay| - |bx| = c$



Sıra Sizde / It is your turn

1. $|\pi-3| + |\pi-4| + |\sqrt{2}-1| + |\sqrt{2}-2|$
toplamının sonucu kaçtır?

2. $f(x) = |x-5| + 1$
fonksiyonunu parçalı fonksiyon şeklinde yazınız.

3. $f(x) = |x^2-1|$
fonksiyonunun grafiğini çiziniz.

4. $f(x) = \begin{cases} x^2-1 & , \ x > 0 \\ -2x-2 & , \ x < 0 \end{cases}$
fonksiyonunun grafiğini çiziniz.

5. $f(x) = \dfrac{|x^2-1|}{x-1}$
fonksiyonunu parçalı fonksiyon şeklinde yazınız.

6. $f(x) = |x+2|$
fonksiyonunun grafiğini çiziniz.

7. $f(x) = |x+2| + 2$
fonksiyonunun grafiğini çiziniz.

8. $f(x) = |x^2+x-12|$
fonksiyonunun grafiğini çiziniz.

9. $f(x) = |\cos x|$
fonksiyonunun grafiğini çiziniz.

10. $f(x) = |\log_3 x| + 2$
fonksiyonunun grafiğini çiziniz.

11. $f(x) = ||x|-1|$
fonksiyonunun grafiğini çiziniz.

12. $f(x) = \dfrac{|x^2-4|}{x-2} + 2$
fonksiyonunun grafiğini çiziniz.

13. $f(x) = \dfrac{x^2}{|x|} + 2$
fonksiyonunun grafiğini çiziniz.

14. $f(x) = |x+4| - |x|$
fonksiyonunun grafiğini çiziniz.

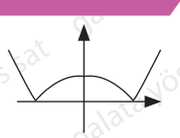
15. $f(x) = |x+4| + |x|$
fonksiyonunun grafiğini çiziniz.

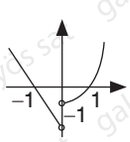
16. $|x| + |2y| = 6$
fonksiyonunun grafiğinin belirttiği kapalı bölgenin alanı kaç birim karedir?

Cevaplar / Answers

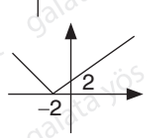
1. 2

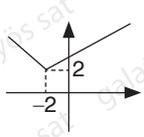
2. $\begin{cases} x-4 & , \ x \geq 5 \\ -x+6 & , \ x < 5 \end{cases}$

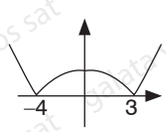
3. 

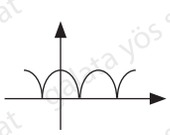
4. 

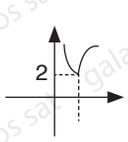
5. $\begin{cases} x+1 & , \ x \geq 1 \\ -x-1 & , \ -1 < x < 1 \\ x+1 & , \ x \leq -1 \end{cases}$

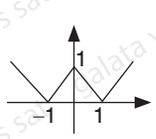
6. 

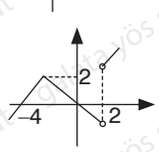
7. 

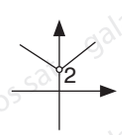
8. 

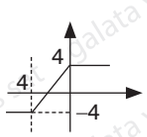
9. 

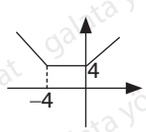
10. 

11. 

12. 

13. 

14. 

15. 

16. 36

SGN (İŞARET) FONKSİYONU

SGN (SIGN) FUNCTION

$$\text{sgn } f(x) = \begin{cases} 1 & , \ f(x) > 0 \\ 0 & , \ f(x) = 0 \\ -1 & , \ f(x) < 0 \end{cases}$$

olarak tanımlanan fonksiyonlara sgn fonksiyonu denir.

Functions defined as SGN f(x) are called sign/sgn functions.

UYARI WARNING

Kritik N: Sgn'nin içini sıfır yapın nokta

Critical point: The point that makes the inside of Sgn zero

Örnek *Example*

- sgn $(\pi - 3) = 1$
  sgn $(e - 3) = -1$
  sgn $(-3) = -1$
  sgn $(\ln 1) = 0$

Örnek *Example*

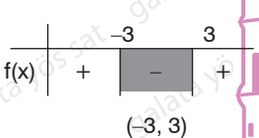
- sgn $(x^2 + 1) = 1$
  sgn $(-x^2 - x - 1) = -1$
  sgn $(\cos x + 2) = 1$

Örnek *Example*

- **sgn $(x^2 - 9) = -1$ ise SS =?**

$x^2 - 9 < 0$

$x = 3$, $x = -3$ } Kritik Nokta *Critical Point*



$(-3, 3)$

Örnek *Example*

- **$0 < x < \pi$ arasında**

sgn $(\cos x) = -1$

ise SS =?

2nd region

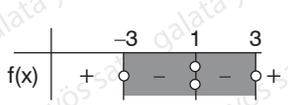
$\cos x < 0 \Rightarrow$ 2. bölgede $\cos x < 0$

$\cos x = 0$ Kritik N. *Critical Point* O halde $\left(\frac{\pi}{2}, \pi\right)$

Örnek *Example*

- **sgn $\left(\frac{x^2 - 9}{x^2 - 2x + 1}\right) = -1$ ise SS =?**

$\frac{x^2 - 9}{x^2 - 2x + 1} < 0$



$(-3, 3) - \{1\}$

Sıra Sizde / It is your turn

1. sgn $(\pi - 3)$ + sgn $(e - 3)$ + sgn $|e - \pi|$ =?

2. sgn $(x^2 + 3)$ + sgn $(e^x + 2)$ =?

3. sgn $(x^2 + x + 1)$ + sgn (-3) =?

4. sgn $(\cos x + 2) + \tan \frac{7\pi}{6}$ = ?

5. sgn $(\tan \pi)$ + sgn $\left(\sin \frac{5\pi}{7} - \cos \frac{5\pi}{7}\right)$ =?

6. sgn $(x - 2) = 1$ ise x =?

7. sgn $(x^2 - 36) = -1$ ise x =?

8. sgn $(x^2 - x - 6) = 0$ ise x =?

9. $0 < x < 2\pi$,
sgn $(\sin x) = 0$ ise x =?

10. sgn $(\log_3 |x - 5|) = 0$ ise x =?

11. sgn $\left(\frac{x}{x^2 - 4}\right) = 1$ ise x =?

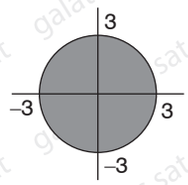
Cevaplar / Answers

1. 1 2. 2 3. 0 4. 2 5. 1
6. $x > 2$ 7. $-6 < x < 6$ 8. $x = 3, x = -2$
9. $x = \pi$ 10. $x = 4, x = 6$ 11. $(-2, 0) \cup (2, \infty)$

Örnek *Example*

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

  belirttiği bölgenin alanı kaç π'dir?
  What is the area of the region that sgn specifies?



$x^2 + y^2 - 9 < 0$

$x^2 + y^2 < 9$

Yarıçapı r = 3 olan dareinin iç kısmı

$\pi \cdot 3^2 = 9\pi$

The inside of the circle with the radius r = 3 is $\pi.32 = 9\pi$

Örnek *Example*

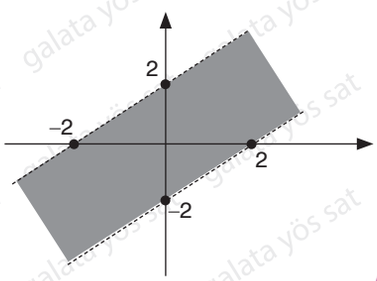
- sgn $(|x - y| - 2) = -1$

  ise grafiğini çiziniz. *Draw the sgn graph.*

$|x - y| - 2 < 0$

$|x - y| < 2$

$-2 < x - y < 2$



Örnek *Example*

- **$y = x \cdot \text{sgn}(x - x^2)$ 'nin grafiğini çiziniz.**

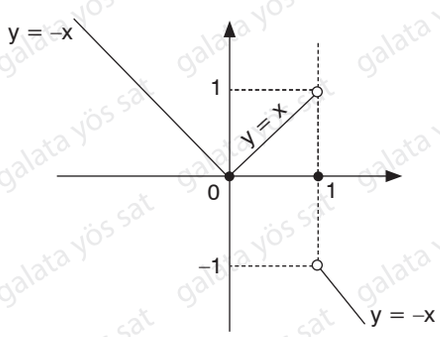
$\Downarrow$ *Draw the Y graph.*

$x - x^2 = 0$

$x = 0 \quad x = 1 \Rightarrow$ Kritik Nokta *Critical Point*

		0		1	
$x - x^2$	–		+		–

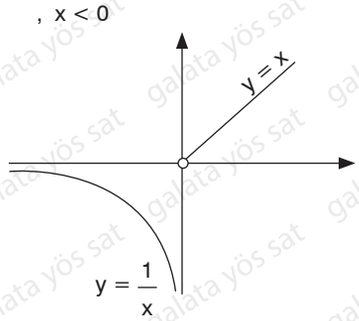
$$y = \begin{cases} x \cdot (-1) \ , & x > 1 & \Rightarrow -x = y \\ x \cdot 0 \ , & x = 1 & \Rightarrow 0 = y \\ x \cdot (+1) \ , & 0 < x < 1 & \Rightarrow x = y \\ x \cdot 0 \ , & x = 0 & \Rightarrow 0 = y \\ x \cdot (-1) \ , & x < 0 & \Rightarrow -x = y \end{cases}$$



Örnek *Example*

- **$y = x^{\text{sgn}x}$ 'in grafiğini çiziniz.** *Draw the Y graph.*

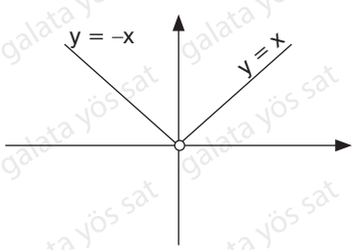
$$= \begin{cases} x^1 & , \ x > 0 \\ \text{tanımsız} & , \ x = 0 \Rightarrow x = 0 \text{ Kritik Nokta} \\ \text{undefined} & \qquad\qquad \text{Critical Point} \\ x^{-1} & , \ x < 0 \end{cases}$$



Örnek *Example*

- **$y = \dfrac{x}{\text{sgn } x}$ 'in grafiğini çiziniz.** *Draw the Y graph.*

$$= \begin{cases} x & , \ x > 0 \\ \text{tanımsız} & , \ x = 0 \\ \text{undefined} & \\ -x & , \ x < 0 \end{cases}$$

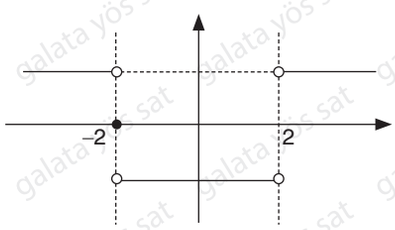


Örnek *Example*

- **$y = \dfrac{\text{sgn}(x + 2)}{\text{sgn}(x - 2)}$ grafiğini çiziniz.** *Draw the Y graph.*

$x = -2 \ , \ x = 2$ Kritik Nokta *Critical Point*

$$= \begin{cases} \dfrac{1}{1} = 1 & , \ x > 2 \\ \text{tanımsız} & , \ x = 2 \\ \text{undefined} & \\ \dfrac{1}{-1} = -1 & , \ -2 < x < 2 \\ 0 & , \ x = -2 \\ \dfrac{-1}{-1} = 1 & , \ x < -2 \end{cases}$$

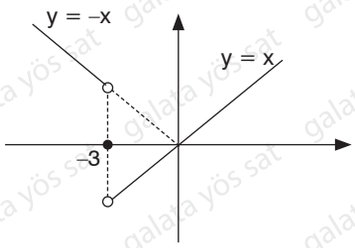


Örnek *Example*

- **y = x.sgn(x + 3) grafiğini çiziniz.** *Draw the Y graph.*

$$y = x \,.\, \underbrace{\operatorname{sgn}(x+3)}_{x=-3} = \begin{cases} x & , \; x > -3 \\ 0 & , \; x = -3 \\ -x & , \; x < -3 \end{cases}$$

Kritik N. *Critical Point*

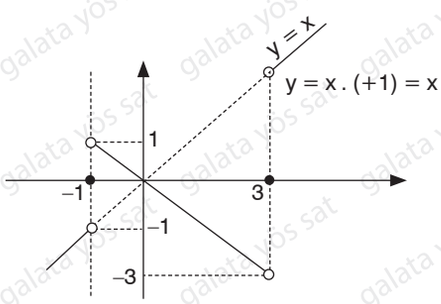


Örnek *Example*

- **$y = x \,.\, \operatorname{sgn}(x^2 - 2x - 3)$ grafiğini bulunuz.** *Find the Y graph.*

$$\underbrace{(x-3)}_{-3} \,.\, \underbrace{(x+1)}_{+1}$$

$x = 3$, $x = -1$ ⇒ Kritik N. *Critical Point*



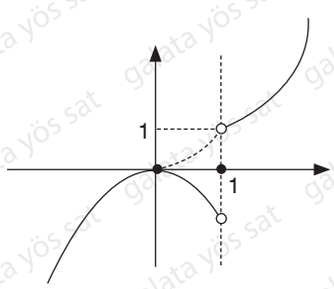
Örnek *Example*

- **$y = x^2 \,.\, \operatorname{sgn}(x - 1)$ grafiğini çiziniz.** *Draw the Y graph.*

$$\underbrace{\operatorname{sgn}(x-1)}_{x=1}$$

Kritik N. *Critical Point*

$$= \begin{cases} x^2 \,.\, 1 & , \; x > 1 \Rightarrow y = x^2 \\ x^2 \,.\, 0 & , \; x = 1 \Rightarrow y = 0 \\ x^2 \,.\, (-1) & , \; x < 1 \Rightarrow y = -x^2 \end{cases}$$

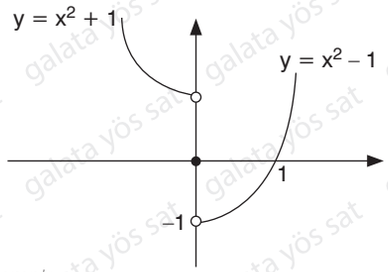


Örnek *Example*

- **$y = x^2 - \underbrace{\operatorname{sgn}(x)}_{x=0}$ grafiğini çiziniz.** *Draw the Y graph.*

Kritik N. *Critical Point*

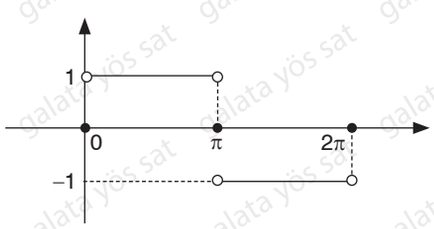
$$= \begin{cases} x^2 - 1 & , \; x > 0 \\ 0 & , \; x = 0 \\ x^2 + 1 & , \; x < 0 \end{cases}$$



Örnek *Example*

- **$f : [0, 2\pi] \to R$**

$f(x) = \operatorname{sgn}(\underbrace{\sin x}_{\sin x = 0 \to x = 0,\ x = \pi,\ x = 2\pi})$ } Kritik *Critical*



Örnek *Example*

- **$x^2 + 2x \,.\, \underbrace{\operatorname{sgn}(1 - x^2)}_{x=1,\ x=-1} = 0$ ise SS = ?** } Kritik N. *Critical Point*

		–1		1	
$1 - x^2$		–	+		–
$\operatorname{sgn}(1 - x^2)$		–1	+1		–1
$x^2 + 2x \,.\, \operatorname{sgn}(1 - x^2)$		$x^2 - 2x$ ⇓ $x^2 - 2x = 0$ ~~$x = 0$~~ ~~$x = 2$~~ Aralıkta değil *not in range*	$x^2 + 2x$ ⇓ $x^2 + 2x = 0$ $\boxed{x = 0}$ ~~$x = -2$~~ Aralıkta değil *not in range*	$x^2 - 2x$ ⇓ $x^2 - 2x = 0$ ~~$x = 0$~~ Aralıkta değil *not in range*	$\boxed{x = 2}$
				$1 = 0$ ∅	$1 = 0$ ∅

SS = {0, 2}

Örnek *Example*

- **$|x-1| = \text{sgn}(3x)$ ise SS = ?**

$x = 1$ $\quad$ $x = 0$

Kritik N. *Critical Point*

		0		1	
sgn (3x)	–1	○	1		1
$\lvert x-1\rvert$	$-x+1$			○	$x-1$
$\lvert x-1\rvert = \text{sgn}(3x)$	$-x+1=-1$		$-x+1=1$		$x-1=1$
	~~$2=x$~~ aralıkta değil *not in range*		~~$x=0$~~ aralıkta değil *not in range*		$x-1=1$ $\boxed{x=2}$
			~~$0=1$~~ ∅		~~$1=0$~~ ∅

SS = {2}

Örnek *Example*

- **$\text{sgn}(x^2 - |x|) = \text{sgn}(-x^2 - 1)$ ise SS = ?**

⇓

her zaman negatif (–1) *always negative (–1)*

$\text{sgn}(x^2 - |x|) = -1$

$x^2 - |x| < 0$

$x = 0$ Kritik N. *Critical Point*

	0	
	$x^2 + x < 0$	$x^2 - x < 0$
	–1	1
+	–	– +

SS = (–1, 1) – {0}

Örnek *Example*

- **$\text{sgn}(x) = |x|$ ise SS =?**

$x = 0$ $\quad$ $x = 0$ $\Rightarrow$ Kritik N. *Critical Point*

	0	
$-1 = -x$	○	$1 = x$
~~$1=x$~~ aralıkta değil *not in range*		$0 = 0$

SS = {0, 1}

Sıra Sizde / It is your turn

1. $\text{sgn}(\pi - e) + \text{sgn}(2 - e) = ?$

2. $0 < x < 2\pi$ $\quad \text{sgn}(\sin x) = -1$ ise SS = ?

3. $\text{sgn}(|x| + |y| - 3) = -1$

denkleminin belirlediği alan kaç birim karedir?

4. $\text{sgn}(|x + y| - 3) = -1$

denkleminin grafiğini çiziniz.

5. $y = x \cdot \text{sgn}(x + 1)$ grafiğini çiziniz.

6. $y = x^{\text{sgn}(x-1)} - 1$ grafiğini çiziniz

7. $y = \dfrac{x-3}{\text{sgn}(x-1)}$ grafiğini çiziniz.

8. $y = \dfrac{\text{sgn}(x^2)}{\text{sgn}(x-2)}$ grafiğini çiziniz.

9. $y = \text{sgn}\, x - \text{sgn}(x-2)$ grafiğini çiziniz.

10. $y = \dfrac{x}{\text{sgn}(x-2)}$ grafiğini çiziniz.

11. $y = \dfrac{x^2-1}{\text{sgn}(x)}$ grafiğini çiziniz.

12. $y = x \cdot \text{sgn}(x) + \text{sgn}(x-1)$ grafiğini çiziniz.

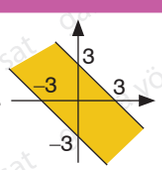
13. $f(x) = |x-2| + \text{sgn}(x)$ ise $f(x)$ in grafiği = ?

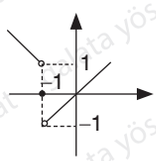
14. $\text{sgn}(x^3 - x) = -1$ ise SS = ?

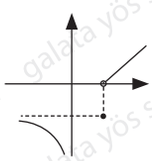
15. $\sum_{k=1}^{100} \text{sgn}(x^2 - 51x + 50) = ?$

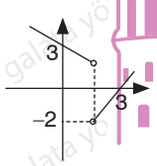
16. $\sum_{k=1}^{10} \text{sgn}(x^2 + x + 1) = ?$

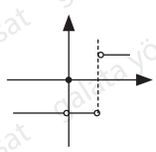
Cevaplar / Answers

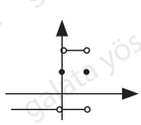
1. 0 2. $(\pi, 2\pi)$ 3. 18 4. 

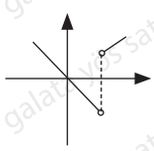
5. 

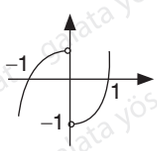
6. 

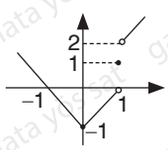
7. 

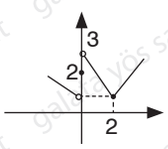
8. 

9. 

10. 

11. 

12. 

13. 

14. $(-\infty, -1) \cup (0, 1)$

15. 2 16. 10

TAM DEĞER FONKSİYONU *FLOOR FUNCTION*

$x \in R$ sayısının tam değeri $[\![x]\!]$ ile gösterilir.
The exact value of $x \in R$ is denoted by x.

Sayı doğrusunda noktanın sağında kalmayan ilk tam sayıdır.
It is the first integer not to the right of the point on the number line.

Eğer tam sayı ise kendisi, tam sayı değil ise soldaki ilk tam sayıdır.
If it is an integer itself, if not it is the first integer on the left.

- $[\![x]\!] = n \Leftrightarrow n \le x < n+1,\ n \in Z$

Örnek *Example*

$[\![5]\!] = 5$

$[\![-2]\!] = -2$

$[\![2,1]\!] = 2$

$[\![3,2]\!] = 3$

$[\![-2,1]\!] = -3$

$[\![\pi]\!] = 3$

$[\![e]\!] = 2$

$[\![-e]\!] = -3$

$[\![\pi - e]\!] = 0$

$[\![\sqrt{2}]\!] = 1$

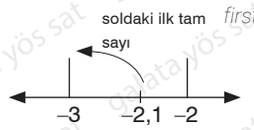
$[\![\sqrt{20}]\!] = 4$

$[\![1,\overline{9}]\!] = 1$

$[\![\log 61]\!] = 1$

$[\![\log_2 20]\!] = 4$

soldaki ilk tam sayı *first integer to the left*



UYARI WARNING

- Kritik Nokta: Tam değer içini tam sayı yapan kritik noktadır.

Critical Point: It is the critical point that makes the floor function an integer.

Not / *Note*

- $\forall a \in Z$ için $[\![x + a]\!] = [\![x]\!] + a$

Örnek *Example*

- $[\![x]\!] + [\![x+2]\!] = 6$

ise x = ?

$[\![x]\!] + [\![x]\!] + 2 = 6 \rightarrow 2[\![x]\!] = 4$

$[\![x]\!] = 2$

$2 \le x < 3$

$[2, 3)$

Sıra Sizde / It is your turn

1. $[\![2]\!] + [\![2,3]\!] = ?$

2. $[\![2,5]\!] + [\![-2]\!] + [\![-2,5]\!] = ?$

3. $[\![\pi]\!] + [\![e-\pi]\!] + [\![\log 33]\!] = ?$

4. $\left[\!\left[\sin\frac{7\pi}{6}\right]\!\right] + \left[\!\left[\cos\frac{6\pi}{7}\right]\!\right] + \left[\!\left[\tan\frac{\pi}{4}\right]\!\right] = ?$

5. $[\![\sqrt{10}]\!] + \left[\!\left[\frac{e}{2}\right]\!\right] + [\![\text{sgn}(-x^2-1)]\!] = ?$

6. $f(x) = [\![x]\!]$ kritik noktalar?

7. $f(x) = [\![\log x]\!]$ kritik noktalar?

8. $f(x) = [\![(e-\pi)]\!] + [\![(-e)]\!] = ?$

9. $[\![x]\!] = 3$ ise $x = ?$

10. $[\![x-2]\!] = -2$ ise $x = ?$

11. $[\![\log_2 30]\!] + [\![\log_3 30]\!] = ?$

Cevaplar / Answers

1. 4 2. –3 3. 3 4. –1 5. 3 6. z

7. 10^z 8. –4 9. $3 \le x < 4$ 10. $0 \le x < 1$

11. 7

Örnek *Example*

- $[\![2x-1]\!] = 0$ ise $x = ?$

$0 \le 2x-1 < 1$

$1 \le 2x < 2$

$\frac{1}{2} \le x < 1 \rightarrow \left[\frac{1}{2}, 1\right)$

Örnek *Example*

- $|[\![x]\!]| = 2$ ise $x = ?$

$[\![x]\!] = -2$ ise $-2 \le x < -1$

$[\![x]\!] = 2$ ise $2 \le x < 3$

$[-2,-1) \cup [2,3)$

Örnek *Example*

- $\left[\!\left[\frac{x+1}{6}+2\right]\!\right] = -2$ ise $x = ?$

$-2 \le \frac{x+1}{6} + 2 < -1$

$-4 \le \frac{x+1}{6} < -3$

$-24 \le x+1 < -18$

$-25 \le x < -19$

$[-25, -19)$

Örnek *Example*

- $[\![x + [\![x + [\![x+2]\!]]\!]]\!] = 11$

$[\![x]\!] + [\![x]\!] + [\![x]\!] + 2 = 11$

$3 \cdot [\![x]\!] = 9$

$[\![x]\!] = 3$

$3 \le x < 4$

$[3, 4)$

Örnek *Example*

- $[\![\log_2 x]\!] = 3$ ise $x = ?$

$3 \le \log_2 x < 4$

$8 \le x < 16$

$[8, 16)$

Sıra Sizde / It is your turn

1. $[\![x-3]\!] = 1$ ise $x = ?$

2. $[\![x+1]\!] = -2$ ise $x = ?$

3. $[\![x+3]\!] = \log_3 5$ ise $x = ?$

4. $[\![|x|]\!] = 3$ ise $x = ?$

5. $|[\![x]\!]| = 3$ ise $x = ?$

6. $[\![[\![[\![x+5]\!]]\!]]\!] = 15$ ise $x = ?$

7. $[\![[\![x+3]\!]]\!] = [\![\log_2 40]\!]$ ise $x = ?$

8. $[\![2x-1]\!] = \left[\!\left[\text{sgn}\left(\sin\frac{11\pi}{14}\right)\right]\!\right]$ ise $x = ?$

Cevaplar / Answers

1. $4 \le x < 5$ 2. $-3 \le x < -2$ 3. $\varnothing$

4. $(-4,-3] \cup [3,4)$ 5. $[3,4) \cup [-3,-2)$

6. $[10, 11)$ 7. $[2, 3)$ 8. $\frac{1}{2} \le x < \frac{3}{2}$

Örnek *Example*

- $2[\![x]\!]^2 + 7[\![x]\!] + 3 = 0$ ise $x = ?$

$(2[\![x]\!] + 1) \cdot ([\![x]\!] + 3) = 0$

$2 \cdot [\![x]\!] + 1 = 0 \quad [\![x]\!] + 3 = 0$

$[\![x]\!] = \frac{-1}{2} \qquad [\![x]\!] = -3$

$\varnothing \qquad -3 \le x < -2 \qquad [-3, -2)$

Örnek *Example*

- $\sum_{k=1}^{\infty} \left[\!\left[\frac{10}{k}\right]\!\right] = \left[\!\left[\frac{10}{1}\right]\!\right] + \left[\!\left[\frac{10}{2}\right]\!\right] + \left[\!\left[\frac{10}{3}\right]\!\right] + \ldots.$

$= 10 + 5 + 3 + 2 + 2 + 1 + 1 + 1 + 1 + 1 + 0 \ldots.$

$= 27$

Örnek *Example*

- $f(x) = x^3 - 3x^2 + 3x$ ise $f(\sqrt[3]{3} + \underbrace{[\![\sqrt{2}]\!]}_{=1}) = ?$

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

$f(x) = (x-1)^3 + 1$

$f(\sqrt[3]{3} + 1) = (\sqrt[3]{3} + 1 - 1)^3 + 1 = 4$

Örnek *Example*

- $f(x) = x - [\![\text{sgn}(-x^2)]\!]$ ise $f(5) = ?$

$f(5) = 5 - [\![\underbrace{\text{sgn}(-25)}_{-1}]\!]$

$= 5 - \underbrace{(-1)}$

$= 6$

Örnek *Example*

- $f(x) = [\![2x]\!] + |x+2| + \text{sgn}(x+2)$ ise $f(-3) = ?$

$f(-3) = -6 + 1 + (-1)$

$= -6$

Örnek *Example*

- $f(x) = [\![|x|]\!] - |[\![x]\!]|$ ise $f(-e) = ?$

$2 - 3$

$= -1$

Örnek *Example*

- $f(x) = \left[\!\left[\sqrt{x}\right]\!\right]^2 + \left[\!\left[-|x|\right]\!\right]$ ise $f(\left[\!\left[15\right]\!\right]) = ?$

$= 3^2 + -15$

$= -6$

Örnek *Example*

- $\left[\!\left[2 - |x|\right]\!\right] = -4$ ise $x = ?$

$-4 \le 2 - |x| < -3$

$-6 \le -|x| < -5$

$5 < |x| \le 6$

$5 < x \le 6 \qquad -6 \le x < -5$

$(5, 6] \cup [-6, -5)$

Örnek *Example*

- $f(x) = \left[\!\left[x\right]\!\right] + \left[\!\left[-x\right]\!\right]$ ise $f(R^+) = ?$

$= a + (-a - 1)$

$= -1$

Örnek *Example*

- $\left[\!\left[\ln 2x\right]\!\right] = \left[\!\left[\ln 10\right]\!\right]$ ise $x = ?$

$\left[\!\left[\ln 2x\right]\!\right] = 2$

$2 \le \ln 2x < 3$

$e^2 \le 2x < e^3$

$\frac{e^2}{2} \le x < \frac{e^3}{2}$

$\left[\frac{e^2}{2}, \frac{e^3}{2}\right)$

Örnek *Example*

- $|x - 2| \cdot \left[\!\left[x - 3\right]\!\right] = 0$ ise $x = ?$

$x - 2 = 0 \qquad 0 \le x - 3 < 1$

$x = 2 \qquad 3 \le x < 4$

$[3, 4)$

$[3, 4) \cup \{2\}$

Not / *Note*

- $n \ge 2$ ve $n \in N$,

$$\left[\!\left[nx\right]\!\right] = \left[\!\left[x\right]\!\right] + \left[\!\left[x + \frac{1}{n}\right]\!\right] + \left[\!\left[x + \frac{2}{n}\right]\!\right] + \ldots + \left[\!\left[x + \frac{n-1}{n}\right]\!\right]$$

Örnek *Example*

- $\left[\!\left[2x - 5\right]\!\right] = \left[\!\left[x + \frac{1}{2}\right]\!\right] + 1$ ise $x = ?$

$\left[\!\left[2x\right]\!\right] - 5 = \left[\!\left[x + \frac{1}{2}\right]\!\right] + 1$

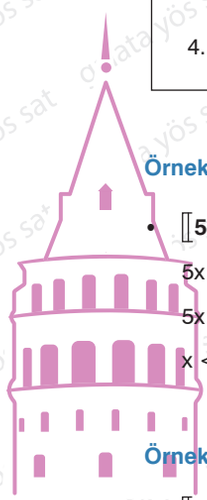
$\left[\!\left[x\right]\!\right] + \left[\!\left[x + \frac{1}{2}\right]\!\right] = \left[\!\left[x + \frac{1}{2}\right]\!\right] + 6$

$\left[\!\left[x\right]\!\right] = 6$

$6 \le x < 7 \quad = [6, 7)$

Not / *Note*

1. $\left[\!\left[f(x)\right]\!\right] < a \Leftrightarrow f(x) < a \quad , \; a \in Z$
2. $\left[\!\left[f(x)\right]\!\right] \le a \Leftrightarrow f(x) < a + 1 , \; a \in Z$
3. $\left[\!\left[f(x)\right]\!\right] > a \Leftrightarrow f(x) \ge a + 1 , \; a \in Z$
4. $\left[\!\left[f(x)\right]\!\right] \ge a \Leftrightarrow f(x) \ge a \quad , \; a \in Z$



Örnek *Example*

- $\left[\!\left[5x - 2\right]\!\right] \le 3$ ise $x = ?$

$5x - 2 < 4$

$5x < 6$

$x < \frac{6}{5}$

Örnek *Example*

- $\left[\!\left[2x - 3\right]\!\right] > 2$ ise $x = ?$

$2x - 3 \ge 3$

$2x \ge 6$

$x \ge 3$

Örnek *Example*

- $\left[\!\left[3x - 3\right]\!\right] < 6$

$3x - 3 < 6$

$3x < 9$

$x < 3$

Örnek *Example*

- $\left[\!\left[4x - 2\right]\!\right] \ge 10$ ise $x = ?$

$4x - 2 \ge 10$

$4x \ge 12$

$x \ge 3$

Örnek *Example*

- $-2 \le [\![x-2]\!] < 4$ ise $x = ?$

$-2 \le [\![x]\!] - 2 < 4$

$0 \le [\![x]\!] < 6$

$0 < [\![x]\!]$, $[\![x]\!] < 6$

$0 < x \qquad x < 6$

$0 < x < 6$

$[0, 6)$

Örnek *Example*

- $\left[\!\left[\left|\frac{x+3}{2}\right|\right]\!\right] < 3$ ise $x = ?$

$\left|\frac{x+3}{2}\right| < 2$

$-3 < \frac{x+3}{2} < 3$

$-6 < x + 3 < 6$

$-9 < x < 3$

$= (-7, 1)$

Örnek *Example*

- $\frac{\pi}{2} < x < \pi$

$f(x) = [\![\cos x]\!] + [\![\sin x]\!]$

2. bölgede $= -1 + 0 = -1$

Örnek *Example*

- $[\![2x]\!] = \underbrace{\text{sgn}(2x)}_{x = 0}$ ise $x = ?$

Kritik N.

0

$[\![2x]\!] = -1$	$[\![2x]\!] = 1$
$-1 \le 2x < 0$	$1 \le 2x < 2$
$-\frac{1}{2} \le x < 0$	$\frac{1}{2} \le x < 1$

$x = 0$
$0 = 0$

$\left[-\frac{1}{2}, 0\right] \cup \left[\frac{1}{2}, 1\right)$

Örnek *Example*

- $[\![x-2]\!] \cdot \left[\!\left[\frac{x}{4}\right]\!\right] = \frac{5}{2}$ ise $x = ?$

$\varnothing$

Örnek *Example*

- $[\![\log_5 5x]\!] + [\![\log_5 x]\!] = 3$ ise $x = ?$

$[\![\log_5 5 + \log_5 x]\!] + [\![\log_5 x]\!] = 3$

$1 + [\![\log_5 x]\!] + [\![\log_5 x]\!] = 3$

$2[\![\log_5 x]\!] = 2$

$[\![\log x]\!] = 1$

$1 \le \log x < 2$

$10^1 \le x < 10^2$

$10 \le x < 100$

$[10, 100)$

Örnek *Example*

- $2x - [\![x]\!] = 3$ ise $x = ?$

$[\![x]\!] = n \in Z$ ise $n \le x < n + 1$

$2x - n = 3$

$2x = n + 3$

$2x - 3 = n$

$x = \frac{n+3}{2}$

$n \le \frac{n+3}{2} < n + 1$

$2n \le n + 3 \qquad n + 3 < 2n + 2$

$n \le 3 \qquad 1 < n$

$1 < n \le 3$

$n = 2 \qquad n = 3$

$\boxed{x = \frac{5}{2} \qquad x = 3}$

Sıra Sizde / It is your turn

1. $[\![x]\!] < 5$ ise $x = ?$

2. $[\![x]\!] > 5$ ise $x = ?$

3. $[\![x + 1]\!] \le 7$ ise $x = ?$

4. $[\![x - 2]\!] \ge 5$ ise $x = ?$

5. $[\![2x - 1]\!] < 5$ ise $x = ?$

6. $[\![[\![x + 2]\!]]\!] \le 7$ ise $x = ?$

7. $[\![x + 3]\!] > [\![\log_2 81]\!]$ ise $x = ?$

Cevaplar / Answers

1. $x < 5$ 2. $x \ge 6$ 3. $x < 7$

4. $x \ge 7$ 5. $x < 3$ 6. $x < 6$

7. $x \ge 4$

Örnek *Example*

- **$f(x) = [\![x]\!]$'nın $[-2, 1]$ aralığında grafiğini çiziniz.**

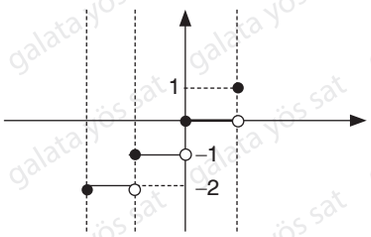
  Graph $f(x) = x$ in the range $[-2, 1]$.

  $-2 \le x < -1 \Rightarrow y = -2$

  $-1 \le x < 0 \Rightarrow y = -1$

  $0 \le x < 1 \Rightarrow y = 0$

  $x = 1 \Rightarrow y = 1$



Örnek *Example*

- **$f : [0, 2\pi] \to R$** *Draw the x graph.*

  $f(x) = [\![\cos x]\!]$'nin grafiğini çiziniz.

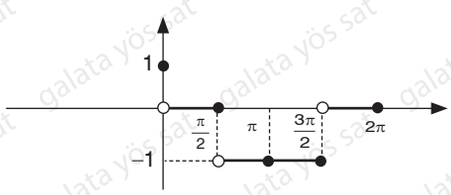
  $x = 0 \Rightarrow y = 1$

  $0 < x \le \frac{\pi}{2} \Rightarrow y = 0$

  $\frac{\pi}{2} < x \le \pi \Rightarrow y = -1$

  $\pi < x \le \frac{3\pi}{2} \Rightarrow y = -1$

  $\frac{3\pi}{2} < x \le 2\pi \Rightarrow y = 0$



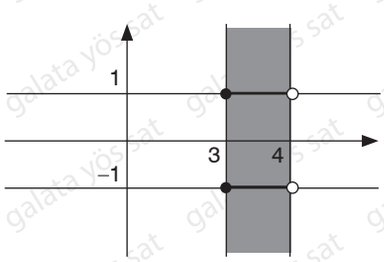
Örnek *Example*

- **$[\![x]\!] = 3$ ve $|y| = 1$ grafiğini çiziniz.**

  Draw the x graph.

  $3 \le x < 4$ ve $y = 1$

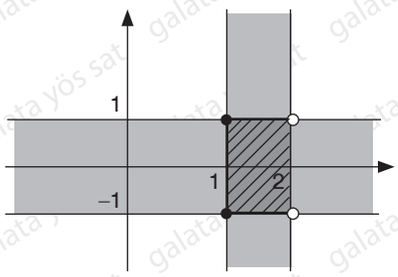
  $y = -1$



Örnek *Example*

- **$[\![x]\!] = 1$ ve $|y| \le 1$ grafiğini çiziniz.** *Draw the x graph.*

$1 \le x < 2$ ve $-1 \le y \le 1$



Örnek *Example*

- **$[-4, 6)$ aralığında $y = \left[\!\left[\frac{x}{2}\right]\!\right]$ grafiğini çiziniz.** *Draw the x graph.*

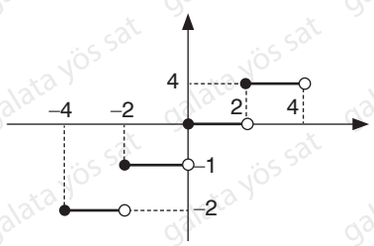
$-4 \le x < -2 \rightarrow y = -2$

$-2 \le x < 0 \rightarrow y = -1$

$-0 \le x < 2 \rightarrow y = 0$

$2 \le x < 4 \rightarrow y = 1$

$4 \le x < 6 \rightarrow y = 2$



Örnek *Example*

- **$[0, 2)$ aralığında $y = [\![2x]\!]$ grafiğini çiziniz.**

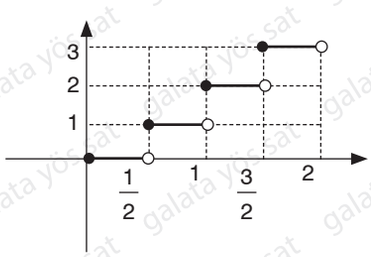
Draw the graph of y = 2x in the interval (0, 2).

$0 \le x < \frac{1}{2} \Rightarrow y = 0$

$\frac{1}{2} \le x < 1 \Rightarrow y = 1$

$1 \le x < \frac{3}{2} \Rightarrow y = 2$

$\frac{3}{2} \le x < 3 \Rightarrow y = 3$



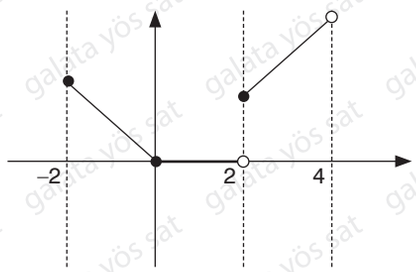
Örnek *Example*

- **$[-2, 4)$ aralığında $y = x \cdot \left[\!\left[\frac{x}{2}\right]\!\right]$ grafiğini çiziniz.** *Draw the x graph.*

$-2 \le x < 0 \Rightarrow y = -x$

$0 \le x < 2 \Rightarrow y = 0$

$2 \le x < 4 \Rightarrow y = x$



Örnek *Example*

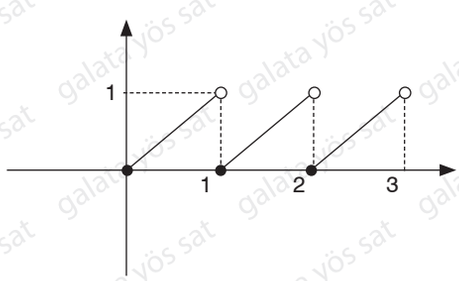
- **$y = x - [\![x]\!]$, $[0, 3)$ aralığında grafiğini çiziniz.**

Draw the graph of y = x−x in the interval (0, 3).

$0 \le x < 1 \Rightarrow y = x$

$1 \le x < 2 \Rightarrow y = x - 1$

$2 \le x < 3 \Rightarrow y = x - 2$



Sıra Sizde / It is your turn

1. $[\![e]\!] + [\![\pi - e]\!] + [\![e - \pi]\!] = ?$

2. $[\![2,5]\!] + [\![\log(1453)]\!] + [\![(\log_2\sqrt{61})]\!] = ?$

3. $[\![x]\!] + [\![x+1]\!] = 7$ ise $x = ?$

4. $[\![3x-2]\!] = 2$ ise $x = ?$

5. $|[\![x]\!]| = 3$ ise $x = ?$

6. $[\![\log_3(x-1)]\!] = 2$ ise $x = ?$

7. $[\![2x+3]\!] = [\![x]\!] + 5$ ise $x = ?$

8. $[\![2x-3]\!] < 7$ ise $x = ?$

9. $[\![3x+1]\!] \geq 5$ ise $x = ?$

10. $\sum_{k=1}^{100} \left[\!\left[\frac{20}{k}\right]\!\right] = ?$

11. $f(x) = [\![\sqrt[3]{x}]\!] + [\![-|x|]\!]$ ise $f(\sqrt{30}) = ?$

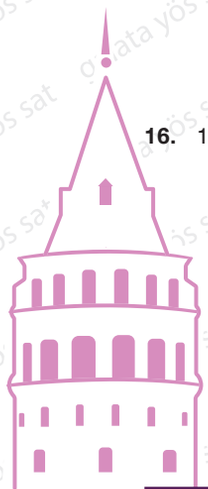
12. $[\![\ln 3x]\!] = [\![\text{sgn}(x^2 + x + 1)]\!]$ ise $x = ?$

13. $|x-3| \cdot \text{sgn}(x^2 - 16) \cdot [\![x+1]\!] = 0$ ise $x = ?$

14. $-2 \leq [\![x-1]\!] \leq 3$ ise $x = ?$

15. $\pi < x < \frac{3\pi}{2}$ ise $f(x) = [\![\sin x]\!] + [\![-\cos x]\!] = ?$

16. $1 \leq x < 4$ ise $y = x \cdot [\![x]\!]$ grafiğini çiziniz.



Cevaplar / Answers

1. 1 2. 7 3. [3, 4) 4. $[\frac{4}{3}, \frac{5}{3})$

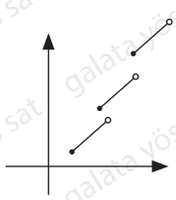
5. $[-3,-2) \cup [3,4)$ 6. [10, 28) 7. $[\frac{3}{2}, \frac{5}{2})$

8. $x < 5$ 9. $x \geq \frac{4}{3}$ 10. 66 11. –5

12. $\frac{e}{3} \leq x < \frac{e^2}{3}$ 13. $[-1,0) \cup \{-4, 3, 4\}$

14. $-1 \leq x < 5$ 15. –1

16.



1. $f(x) = \sqrt{\frac{-x+2}{x+2}}$ **nın tanım kümesi = ?**
Domain of f(x) = ?

A) [–2, 2] B) (–2, 0) C) (–2, 2]
D) (–2, ∞) E) (–∞, 2]

2. $f(x) = 2\log(x-2) + \sqrt{2x-2}$ **nın tanım kümesi?**
Domain of f(x) = ?

A) (2, ∞) B) [1, ∞) C) [2, ∞)
D) (1, ∞) E) (1, 2]

3. $f(x) = x^2 + (a-3)x + a + 2$ **çift fonksiyon olduğuna göre f(a) = ?**
What is f(a), if f(x) is an even function?

A) 9 B) 12 C) 14 D) 15 E) 20

4. f(x) tek fonksiyondur. *f(x): odd function.*

$f(x) + 2f(-x) = 2x^2 + ax^2 + 3ax + \sin x$ **ise** $f(\pi) = ?$

A) 0 B) 6 C) 6π D) –6 E) –6π

5. I. $x^2 + 3$
II. $\cos x - 2\sec x$
III. $|x| + 3$
IV. $x^3 + 5x$
V. 3

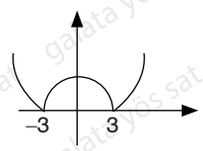
kaç tanesi çift fonksiyondur?
How many of them are even functions?

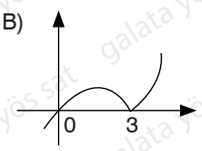
A) 1 B) 2 C) 3 D) 4 E) 5

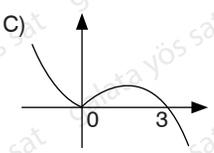
6. $y = |x| - 2$ **ile x – ekseni arasında kalan alan kaçtır?**
What is the area between y =|x| – 2 and the x-axis?

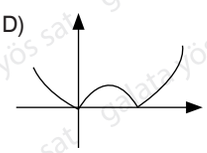
A) 8 B) 4 C) 3 D) 1 E) "

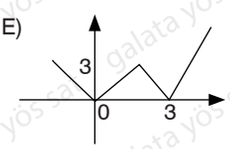
7. $f(x) = x|x-3|$ **nin grafiği aşağıdakilerden hangisidir?** *Which of the following is the graph of f(x) = x|x–3|?*

A)


B)


C)


D)


E)


8. $f(x) = |x-2| + |x| - 4$ **ile x – ekseni arasında kalan kapalı bölgenin alanı kaçtır?**
What is the area of the closed area between f(x) and the x-axis?

A) 4 B) 5 C) 6 D) 7 E) 8

9. $2|x| + 3|y| = 12$**'nin grafiğinin oluşturduğu kapalı bölgenin alanı kaç birim karedir?**
How many unit square is the area of the enclosed zone formed by the graph of 2|x| + 3 |y| = 12?

A) 96 B) 48 C) 36 D) 24 E) 18

10. $x + y \le 4$

$y - 2x \le 4$

$y \ge 0$

eşitliklerini sağlayan (x, y) ikililerinin oluşturduğu kapalı bölgenin alanı kaç birim karedir?

How many unit square is the area of the closed region formed by (x, y) pairs that satisfy their equality?

A) 12 B) 8 C) 7 D) 6 E) 4

11. **sgn $(x^2 - x) = -1$ 'in çözüm kümesi aşağıdakilerden hangisidir?** *SS = ?*

A) [0, 1] B) (0, 1) C) (0, ∞)

D) (−∞, −1) E) (−1, 0]

12. $[\![\log \sqrt{50}\,]\!] - [\![\log_2 x]\!] = \text{sgn}\,(x^2 + 1)$

çözüm kümesi aşağıdakilerden hangisidir? *SS = ?*

A) $[\frac{1}{2}, 1)$ B) [−1, 0) C) [−2, 0)

D) [−1, 1) E) [−1, 0]

13. $[\![2x + 3]\!] > -5$ **'in çözüm kümesi aşağıdakilerden hangisidir?** *SS = ?*

A) $\left(-\frac{7}{2}, \infty\right)$ B) [−4, ∞) C) $\left[-\frac{7}{2}, \infty\right)$

D) (−4, ∞) E) (−5, ∞)

14. $\left[\!\left[\frac{x}{2}\right]\!\right]^2 - \left[\!\left[\frac{x}{2}\right]\!\right] - 6 = 0$

denklemi sağlayan x tam sayıların toplamı kaçtır?

What is the sum of x integers that satisfy the equation?

A) 2 B) 3 C) 4 D) 5 E) 6

15. $|x - 3| = [\![\pi - e]\!]$

denklemini sağlayan x tam sayısı kaçtır?

What is the integer x that satisfies the equation?

A) 3 B) 4 C) 5 D) 3 + e − π E) 0

1-C 2-A 3-C 4-C 5-D 6-B 7-B 8-C 9-B 10-E 11-B 12-A 13-C 14-E 15-A

1. $f(x) = \sqrt{8 - x} + \log_x(x-2)^2$

tanım kümesi aşağıdakilerden hangisidir?
Which of the following is the domain of f(x)?

A) $(2, \infty)$ B) $(0, 8)$ C) $(0, \infty) - \{1, 2\}$
D) $(-\infty, 8)$ E) $(0, 8] - \{1, 2\}$

2. $f(x) = -f(-x)$ ise

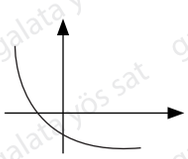
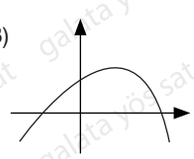
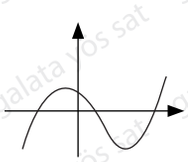
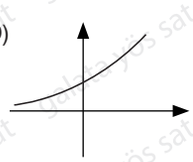
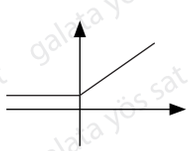
$f(x) = x^5 + (a-3)x^4 - x^3 + (b-2)x^2 + x$

a.b çarpımı kaçtır? *What is a.b product?*

A) 6 B) 5 C) 4 D) 2 E) –6

3. $f : R \to R$

aşağıdaki fonksiyonlardan hangisi artandır?
Which of the following functions is increasing?

A) 
B) 
C) 
D) 
E) 

4. $f(x) = \sqrt[3]{x^2 - x - 6}$

fonksiyonunun en geniş tanım kümesi aşağıdakilerden hangisidir?
Which of the following is the widest domain of f(x)?

A) R B) $[-2, 3]$ C) $[-3, 2]$
D) $(-2, 3)$ E) $(-2, \infty)$

5. $f(x) = \sqrt{10 - |x-1|}$

en geniş tanım kümesi aşağıdakilerden hangisidir?
Which of the following is the widest domain of f(x)?

A) $(-9, 11)$ B) $[-9, 11]$ C) $[0, 11]$
D) $[0, \infty)$ E) R

6. $f(x) = \log_{(x-2)}(6 - x)$

in tanımlı olduğu tam sayıların toplamı kaçtır?
Which of the following is the domain of f(x)?

A) 4 B) 5 C) 7 D) 9 E) 12

7. $f(x) = \log_{|x|}(-x^2 - x + 12)$

nin tanım kümesi aşağıdakilerden hangisidir?
Which of the following is the domain of f(x)?

A) $(-4, 3)$ B) $(-4, 3) - \{-1, 0, 1\}$ C) $(1, 3)$
D) $(-4, 1)$ E) $(1, \infty)$

8. $f(x) = \begin{cases} [\![\log_2 x]\!] & x > 0 \\ 5\,, & x \le 0 \end{cases}$

ise f(100) + f(–100) kaçtır? *What is f(100) + f(–100)?*

A) –96 B) 1 C) 5 D) 6 E) 11

9. $f(x) = \begin{cases} x - 10\,, & x > 1 \\ x - 6\,, & x \le 1 \end{cases}$

ise $f^{-1}(-9)$ kaçtır? *What is $f^{-1}(-9)$?*

A) 1 B) –2 C) –3 D) –4 E) –5

10. $\text{sgn}(x^2 + 1) = \text{sgn}(x - 1)$

in çözüm kümesi nedir? *SS = ?*

A) (1, ∞) B) [1, ∞) C) (0, 1)
D) (–∞, 1) E) R

11. $\sum_{k=1}^{10} \text{sgn}(k - 3)$ **kaçtır?** *What is the sum?*

A) 7 B) 6 C) 5 D) 9 E) 10

12. $\text{sgn}(x^2 + x + 5) + \text{sgn}(\sqrt{3}\ \log_2 5)$

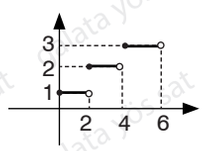
toplamı kaçtır?
What is the sum of $\text{sgn}(x^2 + x + 5) + \text{sgn}(3\log 25)$?

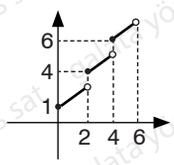
A) 2 B) 1 C) 0 D) –1 E) –2

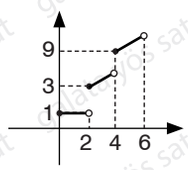
13. [0, 6) aralığında,

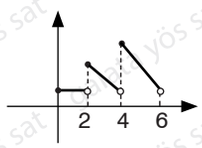
$f(x) = x \cdot \left[\!\left[\frac{x}{2}\right]\!\right] + 1$

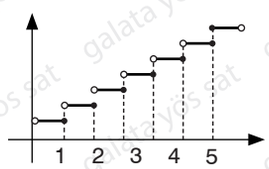
grafiği aşağıdakilerden hangisidir?
Which of the following is the graph of f(x)?

A)


B)


C)


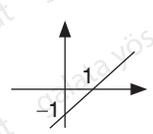
D)


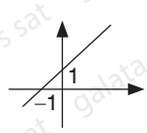
E)


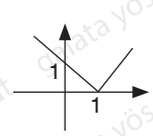
14. $x < 0 < y$

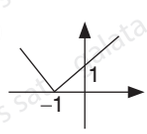
$y = |[\text{sgn}(x^2) + \text{sgn}(2xy) + \text{sgn}(y^2)].x - 1|$

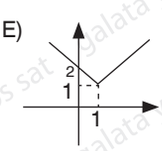
grafiğini çiziniz. *Draw the graph.*

A)


B)


C)


D)


E)


1-E 2-A 3-D 4-A 5-B 6-D 7-B 8-E 9-C 10-A 11-C 12-A 13-C 14-C

1. $x \in Z$

$\text{sgn}\,(3 - |x - 2|) = 1$

sağlayan x'lerin toplamı kaçtır?

What is the sum of the x values that provide?

A) 10 B) 14 C) 15 D) 16 E) 21

2. $x \in Z$

$\text{sgn}\,(x^2 - 25) = -1$

sağlayan x değerleri kaç tanedir?

What are the x values that provide?

A) 11 B) 10 C) 9 D) 8 E) 7

3. $\pi < x < \dfrac{3\pi}{2}$

$\text{sgn}\,(\sin x) + \text{sgn}(\tan x) + [\![\cos x]\!]$

toplamı kaçtır?

What is the sum of sgn(sinx) + sgn(tanx) + cosx?

A) –4 B) –3 C) –1 D) 0 E) 2

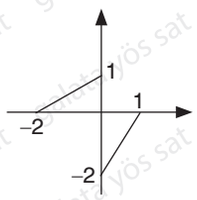
4. $\displaystyle\sum_{k=1}^{20} \text{sgn}\left(\frac{k-1}{k+3}\right)$ **kaçtır?** *What is the sum?*

A) 20 B) 19 C) 17 D) 16 E) 15

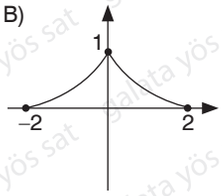
5. **Aşağıdakilerden hangisi tek fonksiyondur?**

Which of the following is an odd function?

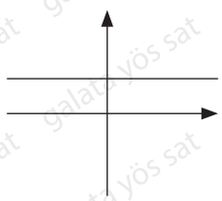
A)



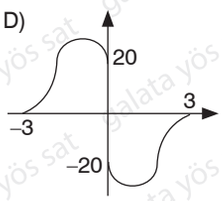
B)



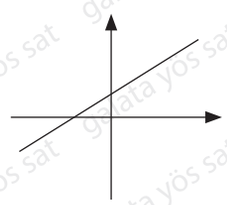
C)



D)



E)



6. $|x| = \text{sgn}\,(-2 + \sin x)$

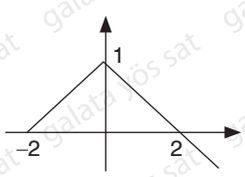
çözüm kümesi aşağıdakilerden hangisidir? *SS = ?*

A) R B) R^+ C) (–2, 2) D) R^- E) Ø

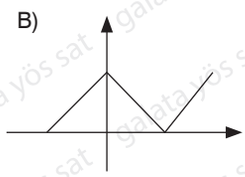
7. **Aşağıdakilerden hangisi çift fonksiyondur?**

Which of the following is an even function?

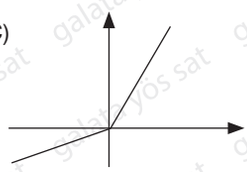
A)



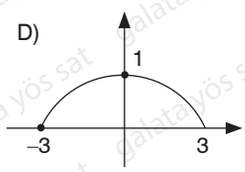
B)



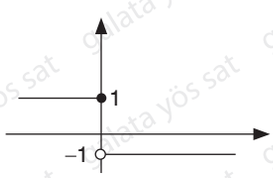
C)



D)



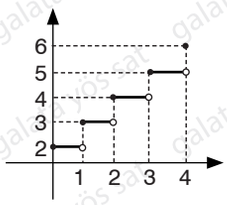
E)

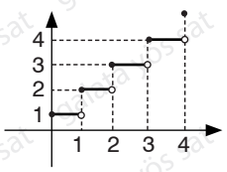


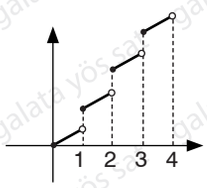
8. [0, 4] aralığında,

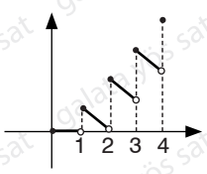
f(x) = ⟦x⟧ + 1'in grafiği hangisidir?

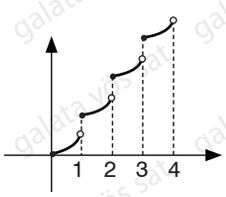
Which of the following is f(x) graph?

A)


B)


C)


D)


E)


9. $⟦x + ⟦x + ⟦x + 2⟧⟧⟧ = 8$

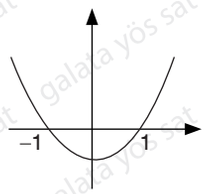
ise x kaçtır? *What is x?*

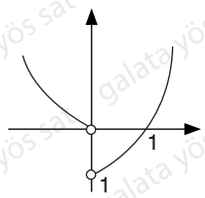
A) [2, 3) B) [3, 4) C) [4, 5)

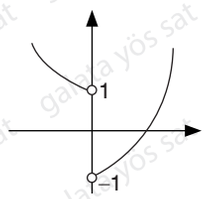
D) [1, 2) E) [0, 1)

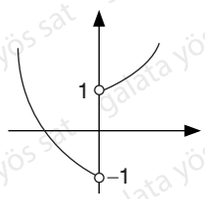
10. **f(x) = x.|x| – 1'in grafiği aşağıdakilerden hangisidir?**

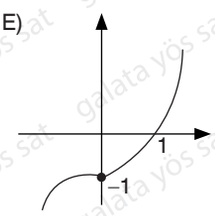
Which of the following is f(x) graph?

A)


B)


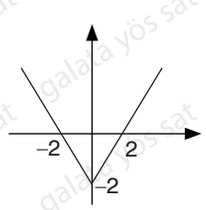
C)


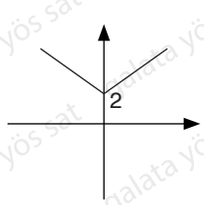
D)


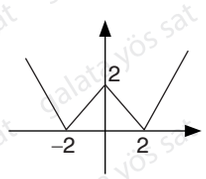
E)


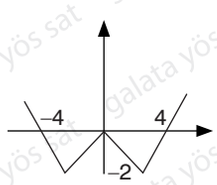
11. **f(x) = ||x| – 2|'nin grafiği aşağıdakilerden hangisidir?**

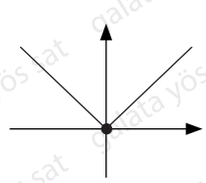
Which of the following is f(x) graph?

A)


B)


C)


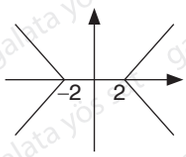
D)


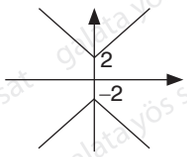
E)


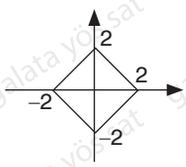
1-A 2-C 3-C 4-B 5-D 6-E 7-D 8-B 9-A 10-E 11-C

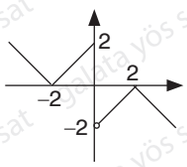
1. **$|x| - |y| = 2$ nin grafiği aşağıdakilerden hangisidir?**

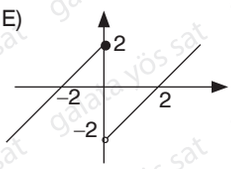
Which of the following is $x - y = 2$ graph?

A)


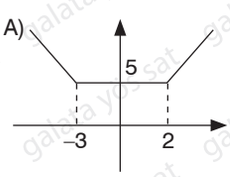
B)


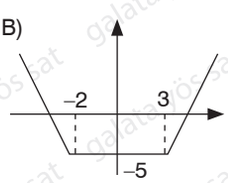
C)


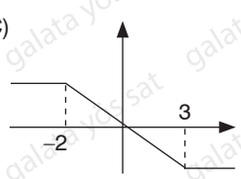
D)


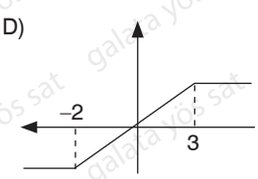
E)


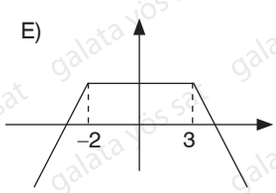
2. **$y = |x-2| + |x+3|$'ün grafiği aşağıdakilerden hangisidir?** *Which of the following is Y graph?*

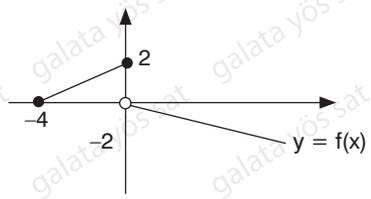
A)


B)


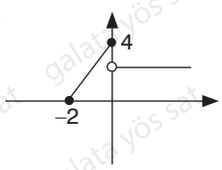
C)


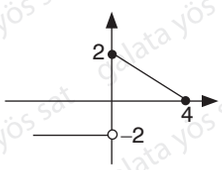
D)


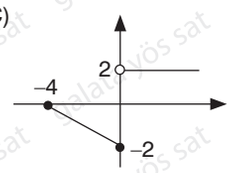
E)


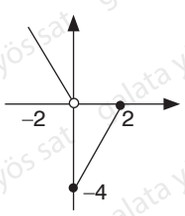
3.


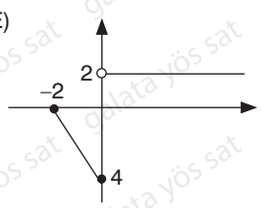
olduğuna göre $f^{-1}(x)$'in grafiği aşağıdakilerden hangisidir? *Which of the following is f−1(x) graph?*

A)


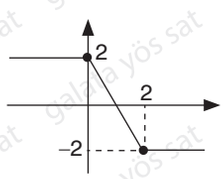
B)


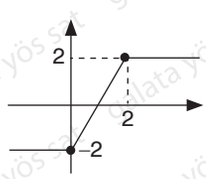
C)


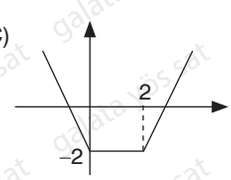
D)


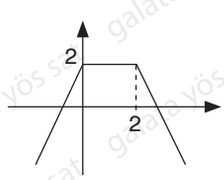
E)


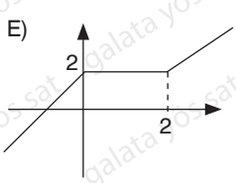
4. **$y = |x| - |x-2|$'nin grafiği aşağıdakilerden hangisidir?** *Which of the following is Y graph?*

A)


B)


C)


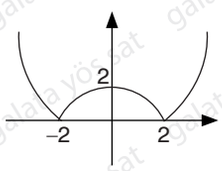
D)


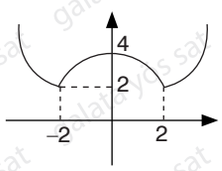
E)


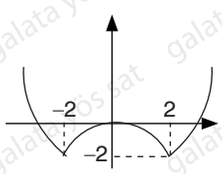
5. $f(x) = |x^2 - 4| - 2$

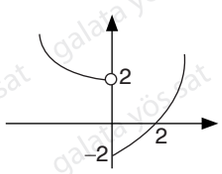
grafiği aşağıdakilerden hangisidir?

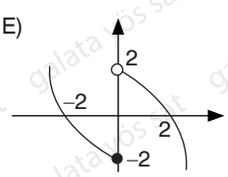
Which of the following f(x) graph?

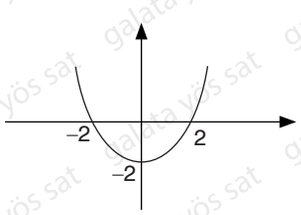
A)


B)


C)


D)


E)


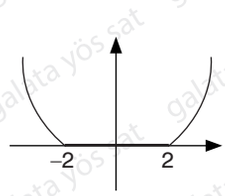
6.


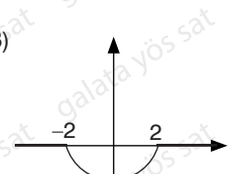
olduğuna göre,

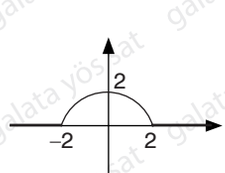
$y = \frac{f(x) - |f(x)|}{2}$ **'nin**

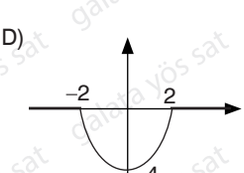
grafiği aşağıdakilerden hangisidir?

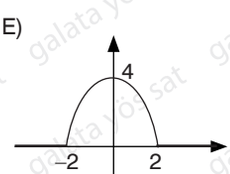
Which of the following Y graph?

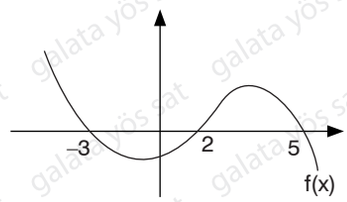
A)


B)


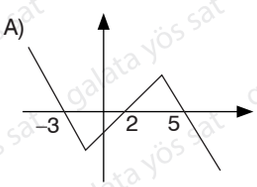
C)


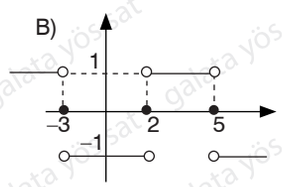
D)


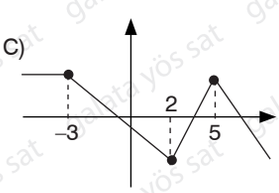
E)


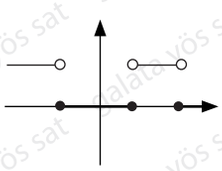
7.


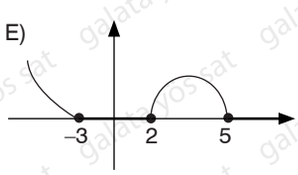
olduğuna göre y = sgn f(x) grafisi aşağıdakilerden hangisidir? *Which of the following Y graph?*

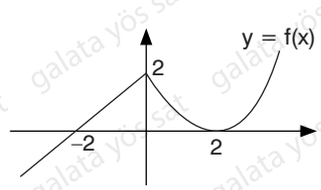
A)


B)


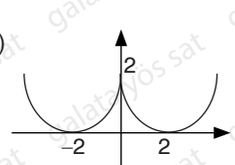
C)


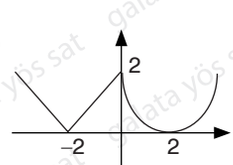
D)


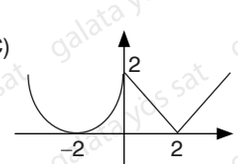
E)


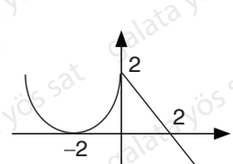
8.


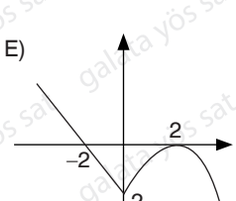
olduğuna göre y = f(–x)'in grafiği aşağıdakilerden hangisidir? *Which of the following Y graph?*

A)


B)


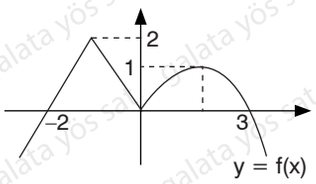
C)


D)


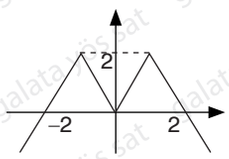
E)


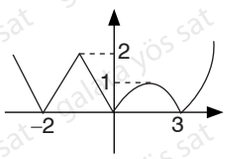
1-A 2-A 3-D 4-B 5-C 6-B 7-B 8-D

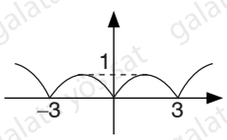
1.

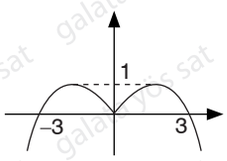


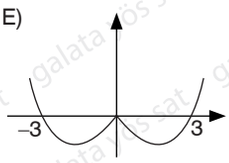
olduğuna göre y = f(|x|) aşağıdakilerden hangisidir? *Which of the following Y graph?*

A)


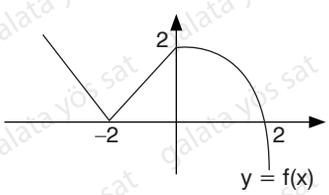
B)


C)


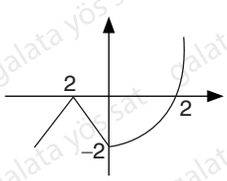
D)


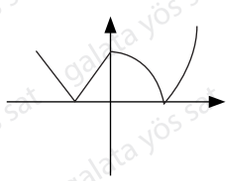
E)


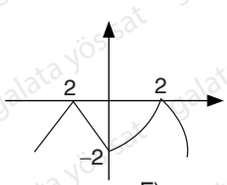
2.

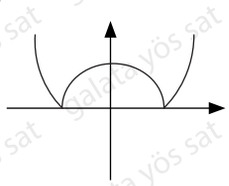


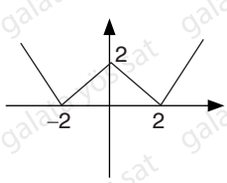
olduğuna göre y = –f(x) aşağıdakilerden hangisidir?
Which of the following Y graph?

A)


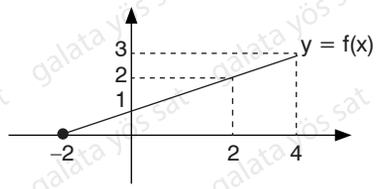
B)


C)


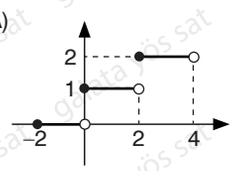
D)


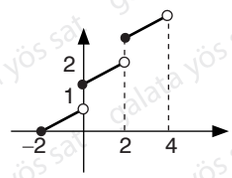
E)


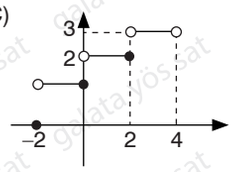
3.

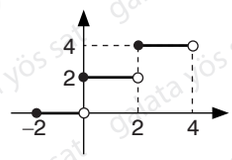


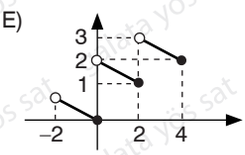
olduğuna göre y = ⟦x⟧ grafiği aşağıdakilerden hangisidir? *Which of the following Y graph?*

A)


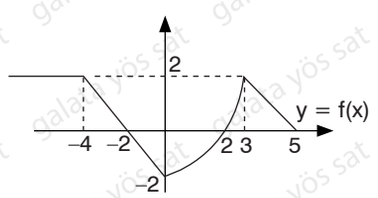
B)


C)


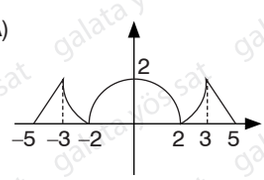
D)


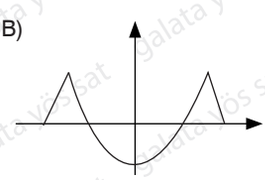
E)


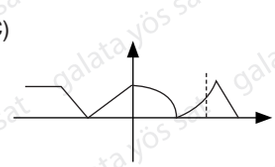
4.

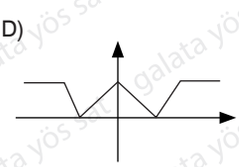


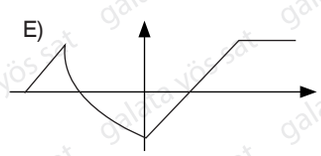
olduğuna göre y = |f(|x|)| aşağıdakilerden hangisidir? *Which of the following Y graph?*

A)


B)


C)


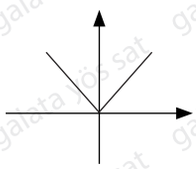
D)


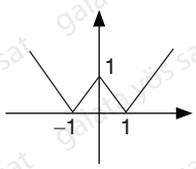
E)


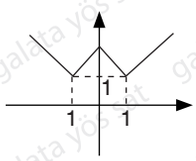
5. $f(x) = ||x| - 1| - \text{sgn}(x^2 + 3)$

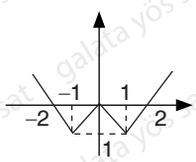
grafiği aşağıdakilerden hangisidir?

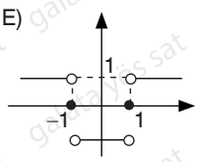
Which of the following is f(x) graph?

A) 

B) 

C) 

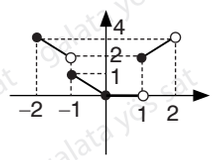
D) 

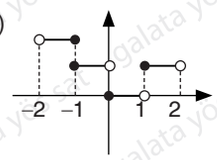
E) 

7. $f : [-2, 2) \to R$

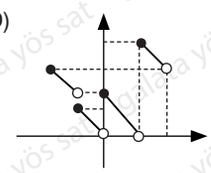
$f(x) = x \cdot [\![x]\!]$ grafiği aşağıdakilerden hangisidir?

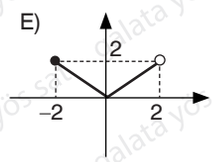
Which of the following is f(x) graph?

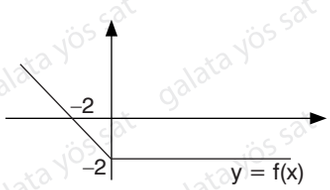
A) 

B) 

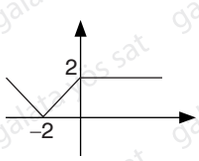
C) 

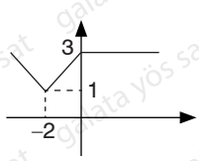
D) 

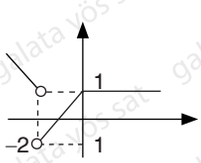
E) 

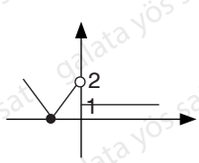
6. 

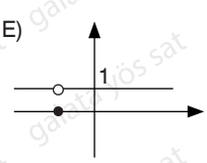
olduğuna göre $y = |f(x)| + \text{sgnf}(x)$'nin grafiği aşağıdakilerden hangisidir?

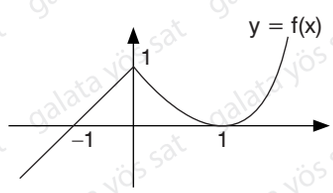
A) 

B) 

C) 

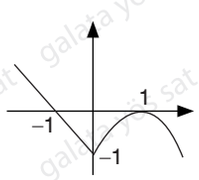
D) 

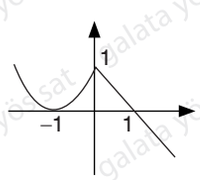
E) 

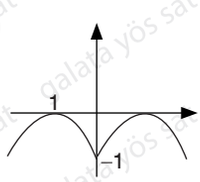
8. 

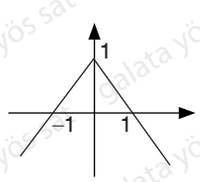
$f(x) = -f(-x)$ grafiği aşağıdakilerden hangisidir?

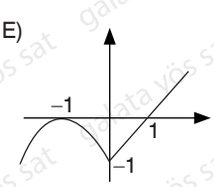
Which of the following is f(x) graph?

A) 

B) 

C) 

D) 

E) 

1-D 2-A 3-A 4-A 5-D 6-C 7-A 8-E

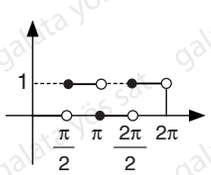
1. $f(x) = \log_x(4 - x^2)$

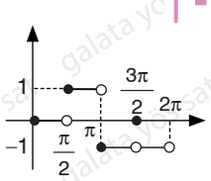
nın tanım kümesi aşağıdakilerden hangisidir?
Which of the following is the domain set of f(x)?

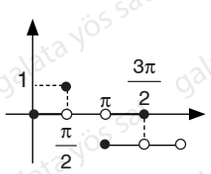
A) $(-2, 2)$ B) $(-2, 2) - \{1\}$ C) $(0, 2) - \{1\}$
D) $(1, 2)$ E) $(0, 1)$

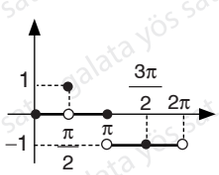
2. $0 \le x < 2\pi$

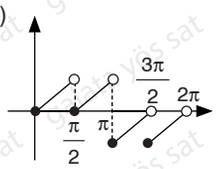
f(x) = ⟦sinx⟧ grafiği aşağıdakilerden hangisidir?
Which of the following is f(x) graph?

A)


B)


C)


D)


E)


3. $2^x + x = 0$

denkleminin çözüm kümesi kaç elemanlıdır?
How many elements does the solution set of the equation have?

A) 0 B) 1 C) 2 D) 3 E) 4

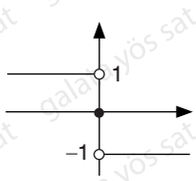
4. $x^2 - 5x + 6\,\text{sgn}x = 0$

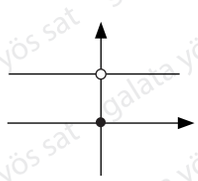
çözüm kümesi aşağıdakilerden hangisidir? *SS = ?*

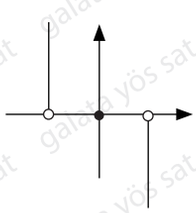
A) $\{-1, 0, 2, 3\}$ B) $\{-1, 0, 2, 3, 6\}$
C) $\{-1, 2, 3\}$ D) $\{2, 3, 6\}$
E) $\{2, 3\}$

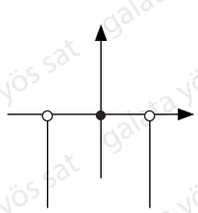
5. $\text{sgn}\,y + x^2 = 0$

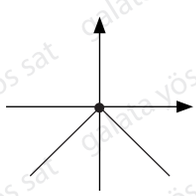
grafiğini çiziniz. *Draw the graph*

A)


B)


C)


D)


E)


6. $\text{sgn}(|x-y|-1) = -1$

$\text{sgn}(|x+y|-6) = -1$

nın kapalı aralığının alanı kaçtır?
What is the area of the closed range?

A) 24 B) 18 C) 15 D) 12 E) 8

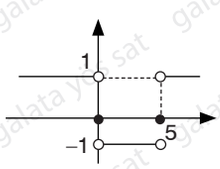
7. $[\![x+2]\!] + |x-5| = 9$

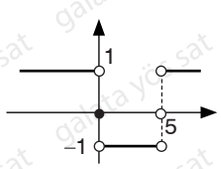
ise x kaçtır? *What is x?*

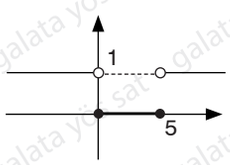
A) 6 B) [6, 7) C) [5, 6) D) [4, 5) E) [3, 4)

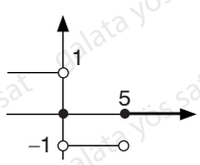
8. $y = \dfrac{\text{sgn}(x)}{\text{sgn}(x-5)}$

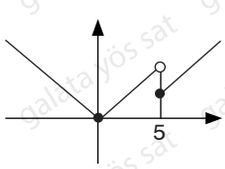
grafiği aşağıdakilerden hangisidir?
Which of the following is Y graph?

A)


B)


C)


D)


E)


9. $f(x) = [\![3x]\!] - |2x+1| - \text{sgn}(x-5)$

ise f(5) kaçtır? *What is f(5)?*

A) 5 B) 4 C) 3 D) 2 E) 1

10. $[\![3x]\!] = \text{sgn } x$

ise çözüm kümesi aşağıdakilerden hangisidir?
SS = ?

A) $\left[\frac{1}{3}, \frac{2}{3}\right) \cup \left[-\frac{1}{3}, 0\right)$ B) $\left[\frac{1}{3}, \frac{2}{3}\right)$

C) $\left[\frac{1}{3}, \frac{2}{3}\right) \cup \left[-\frac{1}{3}, 0\right]$ D) $\left[\frac{1}{3}, \infty\right)$

E) $(0, \infty)$

11. $[\![x+2]\!] \cdot \left[\!\left[\frac{2x}{5}\right]\!\right] = \frac{1}{2}$

çözüm kümesi aşağıdakilerden hangisidir? *SS = ?*

A) $(0, \infty)$ B) $(-\infty, 0)$ C) R

D) $(0, 1)$ E) $\emptyset$

1-C 2-D 3-B 4-A 5-D 6-D 7-A 8-B 9-B 10-C 11-E