Preparing for **AP Precalculus**

The Summer Packet

This assignment is designed to be a review of topics covered in Advanced Algebra. The skills presented in this packet are the prerequisite skills required for success in AP PreCalc. Please complete the packet prior to the first day of class for the 2023/2024 school year. This will be included as a homework grade for Semester 1. The entire left column is worked out in context for you to review before working through the problem on the right on your own. All solutions are in the last pages. Please understand that you are responsible for the information in the packet and these skills will be used in AP PreCalc, but will not be explicitly re-taught. Questions regarding the packet will be addressed within the first week of class. Write down questions as you go. Showing your work and making your thinking visual is extremely important for this course and for the AP Test.

- Please keep your notes from Advanced Algebra and use them to assist you with these topics.
- www.**khanacademy**.org is a great resource that can provide you with additional instruction on many topics if needed.
- If you lose the packet you can reprint it from the Math or Guidance Department Page of the Willowbrook website.
- It is in YOUR BEST INTEREST to complete this packet to prepare you for success in AP PreCalc.
- If you have any questions, email Mr. Chelmecki or Mr. Wahlgren
    - **bchelmecki@dupage88.net**
    - **nwahlgren@dupage88.net**

AP Pre-Calculus Name_____ ID: 1

Summer Packet

Date_____ Period____

Solve each equation.

1) $x + 3(x + 5) = -33 - 2x$

$1x + 3x + 15 = -33 - 2x$
$-15 \quad -15$

$4x = -48 - 2x$
$+2x \quad +2x$

$\frac{6x}{6} = \frac{-48}{6}$

$\boxed{x = \{-8\}}$

2) $17 + 6p = -5 + 8(-7 + 4p)$

3) $8(1 - 4x) = 7x - 31$

$8 - 32x = 7x - 31$
$+32x \quad +32x$

$8 = 39x - 31$
$+31 \quad +31$

$\frac{39}{39} = \frac{39x}{39}$

$\boxed{x = \{1\}}$

4) $30 + 2x = -6 + 5(x + 3)$

5) $-7(v - 2) + 4 = 12 - 6v$

$-7v + 14 + 4 = 12 - 6v$
$+7v \quad +7v$

$18 = 12 + v$
$-12 \quad -12$

$\boxed{\{6\} = v}$

6) $-38 + 8m = -2(5m - 8)$

Solve each equation by factoring or using the quadratic formula.

7) $21v^2 + 9 = -66v$
$+66v \quad +66v$

$21v^2 + 66v + 9 = 0$

$3(7v^2 + 22v + 3) = 0$

$3(7v + 1)(v + 3) = 0$

$v + 3 = 0$

$7v + 1 = 0$
$-1 \quad -1$

$\frac{7v}{7} = \frac{-1}{7}$

$\boxed{v = \{\frac{-1}{7}, -3\}}$

8) $11m^2 + 5 = 12m + 4m^2$

9) $15n^2 - 20n = -8n$
$+8n \quad +8n$

$15n^2 - 12n = 0$

$3n(5n - 4) = 0$

$3n = 0 \quad 5n - 4 = 0$

$\boxed{n = \{0, \frac{4}{5}\}}$

10) $3x^2 + 2x = -5x + 6$

© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Worksheet by Kuta Software LLC

11) $15x^2 + 7 = 7x^2 + 57x$

$-7x^2 \quad -57x \qquad -7x^2 \quad -57x$

$8x^2 - 57x + 7 = 0$

$x = \dfrac{57 \pm \sqrt{(-57)^2 - 4(8)(7)}}{2(8)}$

$x = \dfrac{57 \pm 55}{16}$

$\boxed{x = \left\{7, \frac{1}{8}\right\}}$

12) $43x^2 + 3x - 9 = x^2$

Solve each equation.

13) $36^{-x-1} = 216^{3x}$

$(6^2)^{(-x-1)} = (6^3)^{3x}$

$6^{-2x-2} = 6^{9x}$

$-2x - 2 = 9x$

$+2x \qquad +2x$

$\dfrac{-2}{11} = \dfrac{11x}{11}$

$\boxed{x = \left\{\frac{-2}{11}\right\}}$

14) $81^{x-3} = 27$

15) $64^x = 16$

$(4^3)^x = 4^2$

$4^{3x} = 4^2$

$\dfrac{3x}{3} = \dfrac{2}{3}$

$x = \left\{\dfrac{2}{3}\right\}$

16) $125^{-3n-1} = \dfrac{1}{5}$

Solve each equation. Round your answers to the nearest thousandth.

17) $4^{-7k} + 10 = 13$

$-10 \quad -10$

$\log 4^{-7k} = \log 3$

$-7k \dfrac{\log 4}{\log 4} = \dfrac{\log 3}{\log 4}$

$\dfrac{-7k}{-7} = \dfrac{.792}{-7}$

$\boxed{k = \{-0.113\}}$

18) $20^{-5m} + 3 = 60$

19) $e^{-7k} + 7 = 93$

$-7 \quad -7$

$\log e^{-7k} = \log 86$

$-7k \dfrac{\log e}{\log e} = \dfrac{\log 86}{\log e}$

$\dfrac{-7k}{-7} = \dfrac{4.454}{-7}$

$k = \{-0.636\}$

20) $-4 \cdot 3^{x-10} = -69$

Worksheet by Kuta Software LLC

© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Solve each equation.

21) $\log_{18}(-4p-9) = \log_{18}(-3p)$

$-4p - 9 = -3p$
$+4p \qquad +4p$
$-9 = 1p$
$\boxed{p = \{-9\}}$

22) $\log_{20}(-5m) = \log_{20}(-4m+4)$

Solve each equation. Remember to check for extraneous solutions.

23) $\left(\sqrt{7r+65}\right)^2 = (r+5)^2$

$7r + 65 = r^2 + 10r + 25$
$-7r \quad -65 \qquad -7r \quad -65$
$0 = r^2 + 3r - 40$
$0 = (r+8)(r-5)$
$r = \{\cancel{-8}, 5\}$ EXTRANEOUS
$\boxed{r = \{5\}}$

24) $n - 4 = \sqrt{3n-14}$

25) $\left(\sqrt{\frac{n}{8}}\right)^2 = \left(\sqrt{3n-46}\right)^2$

$8 \cdot \frac{n}{8} = (3n-46) \cdot 8$
$n = 24n - 368$
$-24n \quad -24n$
$-23n = -368$
$\boxed{n = \{16\}}$

26) $\sqrt{2p-1} = \sqrt{7-2p}$

27) $(x)^2 = \left(\sqrt{-24+10x}\right)^2$

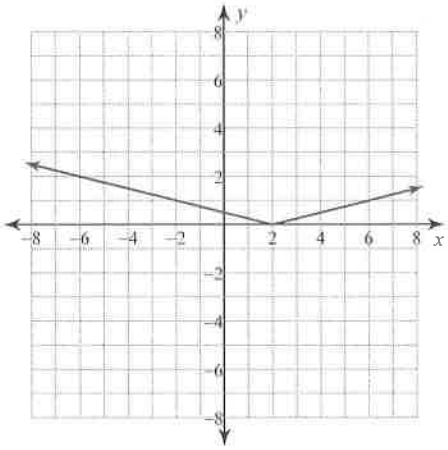
$x^2 = -24 + 10x$
$x^2 - 10x + 24 = 0$
$(x-4)(x-6) = 0$
$x = \{4, 6\}$

28) $\sqrt{16-6p} = p$

Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Each graph represents a relation. Determine which relation are functions. Then, determine the domain and range (use interval notation with parenthesis and/or brackets). State intervals for increasing/decreasing and positive/negative. Last, state left and right end behavior using limit notation.

29)



1) YES, IT IS A FUNCTION

2) DOMAIN: $(-\infty, \infty)$

RANGE: $[0, \infty)$

3) INCREASING: $(2, \infty)$

DECREASING: $(-\infty, 2)$

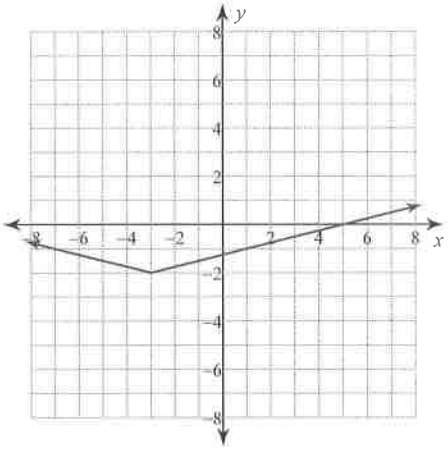
4) POSITIVE: $(-\infty, 2) \cup (2, \infty)$

NEGATIVE: NONE

5) AS $x \to -\infty$, $f(x) \to \infty$

AS $x \to \infty$, $f(x) \to \infty$

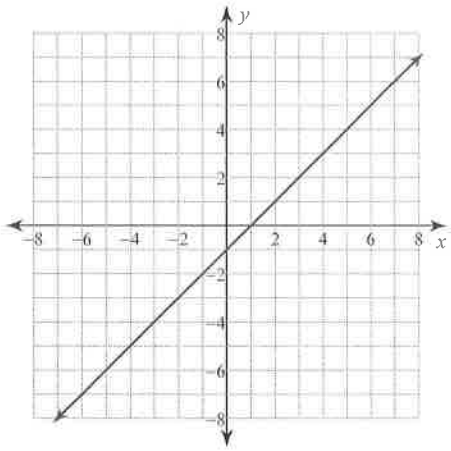
30)



Worksheet by Kuta Software LLC

© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

31)



1) YES IT IS A FUNCTION.

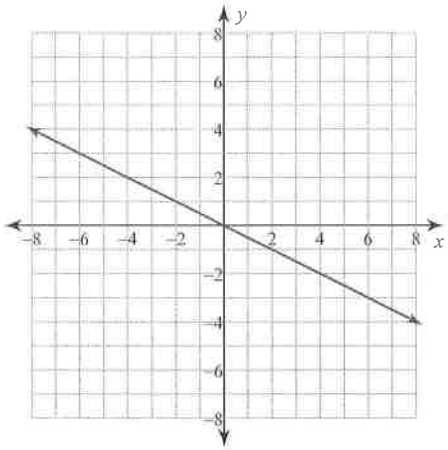
2) DOMAIN: $(-\infty, \infty)$ RANGE $(-\infty, \infty)$

3) INCREASING $(-\infty, \infty)$
DECREASING: NONE

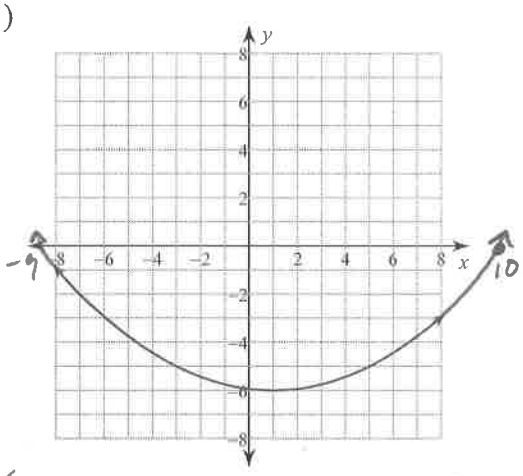
4) POSITIVE: $(1, \infty)$ NEGATIVE $(-\infty, 1)$

5) AS $x \to -\infty$, $f(x) \to -\infty$
AS $x \to \infty$, $f(x) \to \infty$

32)



33)



1) YES, IT IS A FUNCTION

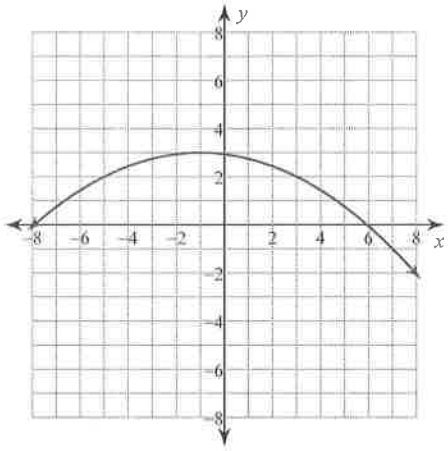
2) DOMAIN $(-\infty, \infty)$ RANGE $[-6, \infty)$

3) INCREASING $(1, \infty)$
DECREASING $(-\infty, 1)$

4) POSITIVE $(-\infty, -9) \cup (10, \infty)$
NEGATIVE $(-9, 10)$

5) AS $x \to -\infty$, $f(x) \to \infty$
AS $x \to \infty$, $f(x) \to \infty$

34)



Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Perform the indicated operation.

35) $f(n) = n^2 - 5 + 2n$
$g(n) = 3n + 5$
Find $f(n) - g(n)$

$f(n) - g(n) = (n^2 - 5 + 2n) - (3n + 5)$
$= n^2 + 2n - 5 - 3n - 5$
$f(n) - g(n) = n^2 - n - 10$

36) $h(n) = n^2 + 1$
$g(n) = n - 1$
Find $h(n) - g(n)$

37) $f(a) = a - 3$
$g(a) = 3a^2 - 2a$
Find $f(a) + 4g(a)$

$f(a) + 4g(a) = (a - 3) + 4(3a^2 - 2a)$
$= a - 3 + 12a^2 - 8a$
$f(a) + 4g(a) = 12a^2 - 7a - 3$

38) $g(t) = t^2 - 3t$
$f(t) = 2t$
Find $3g(t) + 4f(t)$

39) $g(x) = 2x + 1$
$h(x) = x^3 + 5$
Find $g(x) \cdot h(x)$

$g(x) \cdot h(x) = (2x + 1)(x^3 + 5)$
$= 2x^4 + 10x + x^3 + 5$
$g(x) \cdot h(x) = 2x^4 + x^3 + 10x + 5$

40) $h(a) = a + 2$
$g(a) = 3a + 2$
Find $h(a) \cdot g(a)$

41) $g(n) = -2n^2 + 5n$
$h(n) = 3n - 3$
Find $g(h(n))$

$g(h(n)) = g(3n - 3)$
$g(3n - 3) = -2(3n - 3)^2 + 5(3n - 3)$
$= -2(3n - 3)(3n - 3) + 15n - 15$
$= -2(9n^2 \underbrace{- 9n - 9n}_{-18n} + 9) + 15n - 15$
$= -18n^2 + 36n - 18 + 15n - 15$
$g(h(n)) = -18n^2 + 51n - 33$

42) $g(n) = n^2 + 5n$
$f(n) = -4n - 3$
Find $g(f(n))$

Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

43) $h(n) = -3n - 3$
$g(n) = n^3 + 5n^2$
Find $h(g(n))$

$h(g(n)) = h(n^3+5n^2)$

$h(n^3+5n^2) = -3(n^3+5n^2) - 3$

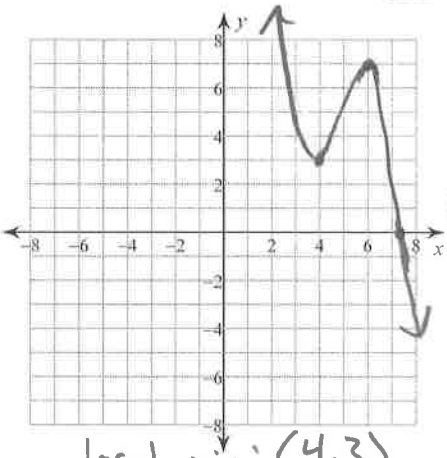
$h(g(n)) = -3n^3 - 15n^2 - 3$

44) $g(x) = 4x - 1$
$f(x) = 2x^3 - 2x^2$
Find $g(f(x))$

Use your calculator. Sketch the graph of each function. Label the max and mins and zeroes of each function.

y-int: (0,115)

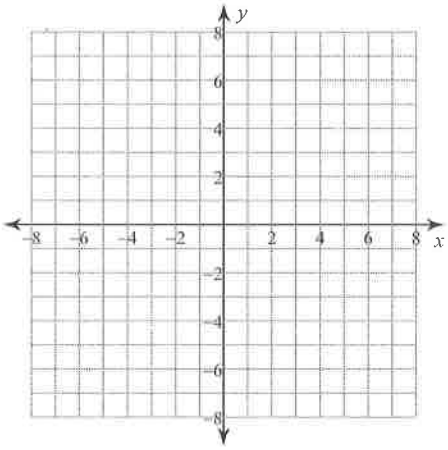
45) $f(x) = -x^3 + 15x^2 - 72x + 115$



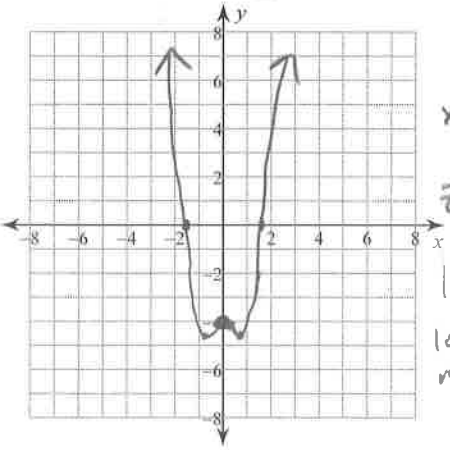
x-int: (7.279,0)

local min: (4,3)
local max: (6,7)
zero: {7.279}

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



47) $f(x) = x^4 - x^2 - 4$ y-int: (0,-4)

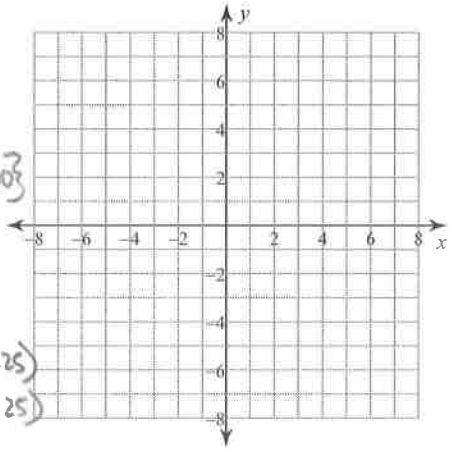


x-int: (-1.600,0)
(1.600,0)
Zeros: {-1.600, 1.600}

local max @ (0,-4)

local and absolute min @ (-0.707,-4.25)
(0.707,-4.25)

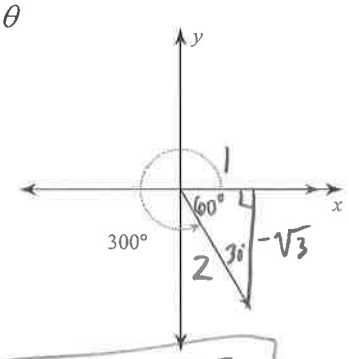
48) $f(x) = x^3 + 14x^2 + 60x + 78$



Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

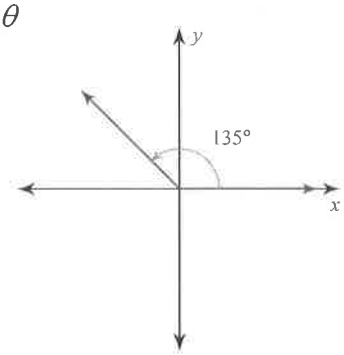
Find the exact value of each trigonometric function.

49) $\tan\theta$

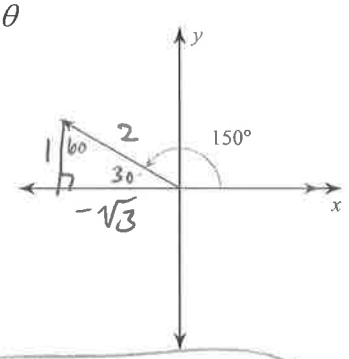


$\tan 300° = \frac{-\sqrt{3}}{1}$

50) $\cos\theta$

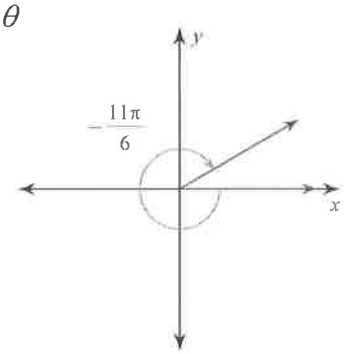


51) $\cos\theta$

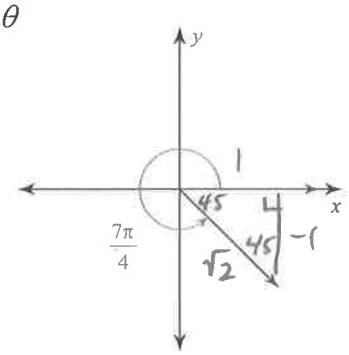


$\cos 150° = \frac{-\sqrt{3}}{2}$

52) $\sin\theta$

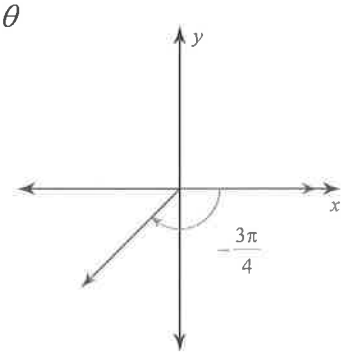


53) $\sin\theta$



$\sin\left(\frac{7\pi}{4}\right) = \frac{-1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} \rightarrow \frac{-\sqrt{2}}{2}$

54) $\tan\theta$



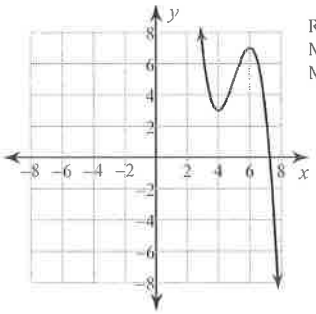
Worksheet by Kuta Software LLC

© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Answers to Summer Packet (ID: 1)

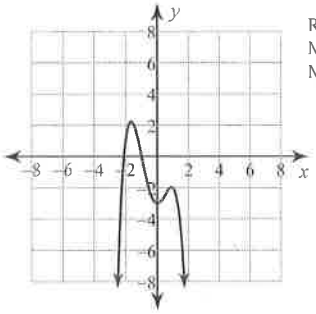
1) $\{-8\}$
2) $\{3\}$
3) $\{1\}$
4) $\{7\}$
5) $\{6\}$
6) $\{3\}$
7) $\left\{-\frac{1}{7}, -3\right\}$
8) $\left\{\frac{5}{7}, 1\right\}$
9) $\left\{\frac{4}{5}, 0\right\}$
10) $\left\{\frac{2}{3}, -3\right\}$
11) $\left\{\frac{1}{8}, 7\right\}$
12) $\left\{\frac{3}{7}, -\frac{1}{2}\right\}$
13) $\left\{-\frac{2}{11}\right\}$
14) $\left\{\frac{15}{4}\right\}$
15) $\left\{\frac{2}{3}\right\}$
16) $\left\{-\frac{2}{9}\right\}$
17) -0.113
18) -0.270
19) -0.636
20) 12.592
21) $\{-9\}$
22) $\{-4\}$
23) $\{5\}$
24) $\{5, 6\}$
25) $\{16\}$
26) $\{2\}$
27) $\{6, 4\}$
28) $\{2\}$
29) Domain: $(-\infty, \infty)$
Range: $[0, \infty)$
30) Domain: $(-\infty, \infty)$
Range: $[-2, \infty)$
31) Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
32) Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$
33) Domain: $(-\infty, \infty)$
Range: $[-6, \infty)$
34) Domain: $(-\infty, \infty)$
Range: $(-\infty, 3]$
35) $n^2 - n - 10$
36) $n^2 - n + 2$
37) $12a^2 - 7a - 3$
38) $3t^2 - t$
39) $2x^4 + x^3 + 10x + 5$
40) $3a^2 + 8a + 4$
41) $-18n^2 + 51n - 33$
42) $16n^2 + 4n - 6$
43) $-3n^3 - 15n^2 - 3$
44) $8x^3 - 8x^2 - 1$

45)



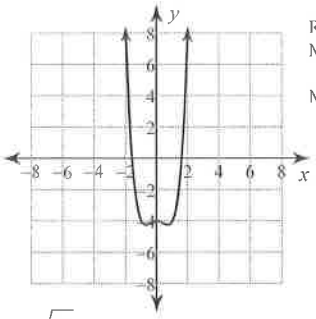
Real Zeros: 7.3
Minima: (4, 3)
Maxima: (6, 7)

46)



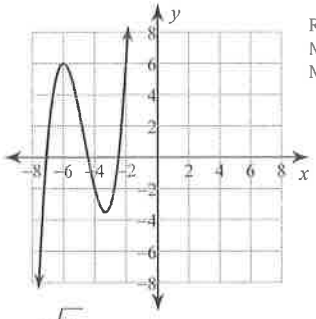
Real Zeros: −2.1, −1
Minima: (0, −3)
Maxima: (−1.7, 2.2)
(0.9, −2)

47)



Real Zeros: −1.6, 1.6
Minima: (−0.7, −4.3)
(0.7, −4.3)
Maxima: (0, −4)

48)



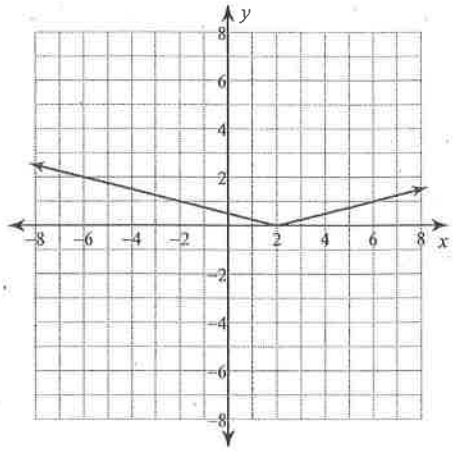
Real Zeros: −7.1, −4.4, −2.5
Minima: (−3.3, −3.5)
Maxima: (−6, 6)

49) $-\sqrt{3}$
50) $-\frac{\sqrt{2}}{2}$
51) $-\frac{\sqrt{3}}{2}$
52) $\frac{1}{2}$
53) $-\frac{\sqrt{2}}{2}$
54) 1

Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

Each graph represents a relation. Determine which relation are functions. Then, determine the domain and range (use interval notation with parenthesis and/or brackets). State intervals for increasing/decreasing and positive/negative. Last, state left and right end behavior using limit notation.

29)



1) YES, IT IS A FUNCTION

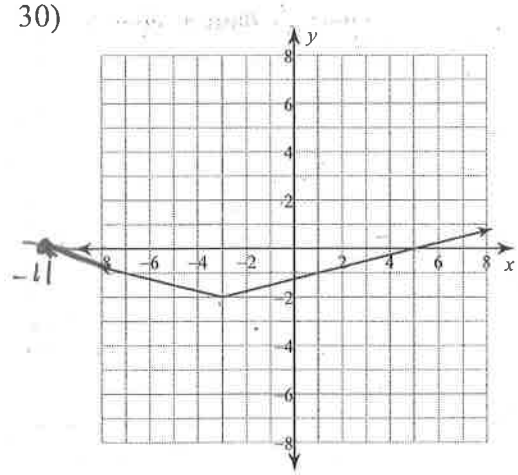
2) DOMAIN: $(-\infty, \infty)$
RANGE: $[0, \infty)$

3) INCREASING: $(2, \infty)$
DECREASING: $(-\infty, 2)$

4) POSITIVE: $(-\infty, 2) \cup (2, \infty)$
NEGATIVE: NONE

5) AS $x \to -\infty$, $f(x) \to \infty$
AS $x \to \infty$, $f(x) \to \infty$

30)



1) YES, IT IS A FUNCTION

2) DOMAIN: $(-\infty, \infty)$
RANGE: $[-2, \infty)$

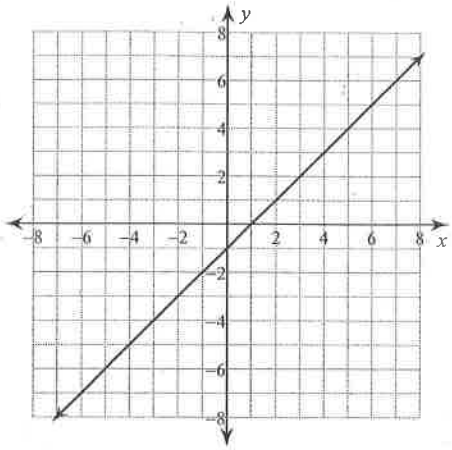
3) INCREASING $(-3, \infty)$
DECREASING $(-\infty, -3)$

4) POSITIVE $(-\infty, -11) \cup (5, \infty)$
NEGATIVE $(-11, 5)$

5) AS $x \to -\infty$, $f(x) \to \infty$
AS $x \to \infty$, $f(x) \to \infty$

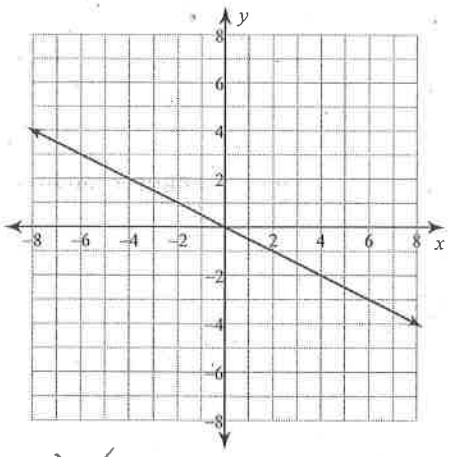
Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.

31)



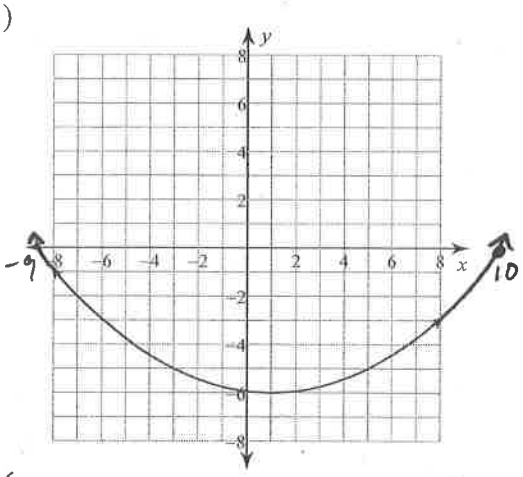
1) YES IT IS A FUNCTION.
2) DOMAIN: $(-\infty, \infty)$ RANGE $(-\infty, \infty)$
3) INCREASING $(-\infty, \infty)$
DECREASING: NONE
4) POSITIVE: $(1, \infty)$ NEGATIVE $(-\infty, 1)$
5) AS $x \to -\infty$, $f(x) \to -\infty$
AS $x \to \infty$, $f(x) \to \infty$

32)



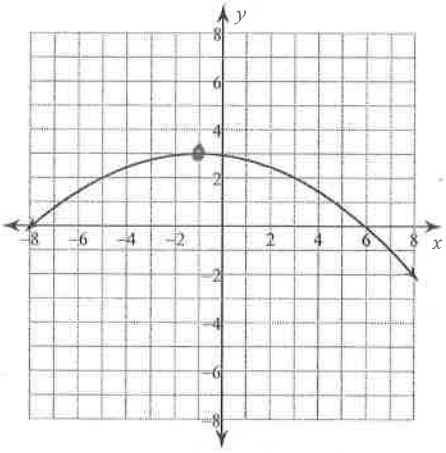
1) YES IT IS A FUNCTION.
2) DOMAIN: $(-\infty, \infty)$ RANGE: $(-\infty, \infty)$
3) INCREASING: NONE
DECREASING: $(-\infty, \infty)$
4) POSITIVE: $(-\infty, 0)$ NEGATIVE: $(0, \infty)$
5) AS $x \to -\infty$, $f(x) \to \infty$
AS $x \to \infty$, $f(x) \to -\infty$

33)



1) YES, IT IS A FUNCTION
2) DOMAIN $(-\infty, \infty)$ RANGE $[-6, \infty)$
3) INCREASING $(1, \infty)$
DECREASING $(-\infty, 1)$
4) POSITIVE $(-\infty, -9) \cup (10, \infty)$
NEGATIVE $(-9, 10)$
5) AS $x \to -\infty$, $f(x) \to \infty$
AS $x \to \infty$, $f(x) \to \infty$

34)



1) YES, IT IS A FUNCTION
2) DOMAIN $(-\infty, \infty)$ RANGE $(-\infty, 3]$
3) INCREASING $(-\infty, 3)$
DECREASING $(3, \infty)$
4) POSITIVE: $(-8, 6)$
NEGATIVE: $(-\infty, -8) \cup (6, \infty)$
5) AS $x \to -\infty$, $f(x) \to -\infty$
AS $x \to \infty$, $f(x) \to -\infty$

Worksheet by Kuta Software LLC
© 2023 Kuta Software LLC. All rights reserved. Made with Infinite Algebra 2.