COWLEY COUNTY COMMUNITY COLLEGE
REVIEW GUIDE
Compass College Algebra – Level 3 .

This study guide is for students trying to test into Calculus or Trigonometry. There are three levels of math study guides.

Functions

1. If $f(x)=3x^2-2x+4$, find $f(-2)$
2. If $f(x)=3x-2$ and $g(x)= x^2-4x+1$, find:

   a. $(f+g)(x)$
   b. $(f-g)(x)$
   c. $(fg)(x)$
   d. $\left(\frac{f}{g}\right)(x)$
   e. $(f\circ g)(x)$
   f. $(g\circ f)(x)$
   g. $f(g(2))$

3. If $f(x)=2x-3$, find $f^{-1}(x)$
4. If $f(x)=\sqrt[3]{4x+1}$, find $f^{-1}(x)$
5. If $f(x)$ contains the point (4, 1), then $f^{-1}(x)$ must contain what point?

6. Find the domain of each function:

   a. $f(x)=x^2-7x+4$
   b. $f(x)=\frac{7}{4x-9}$
   c. $f(x)=\frac{x-1}{x^2-2x-8}$
   d. $f(x)=\sqrt{3x+7}$

7. If $\frac{(2x^2+kx+3)}{(x-3)}=2x-1$, then find the value of *k*.
8. If $x=4y+1$ and $z=3x-5$, find an expression for *z* in terms of *y*.
9. Find the vertex of the function $f(x)=3x^2+6x-5$
10. What are the roots of the function $f(x)=2x^2-8x+3$?
11. Find the zeroes of the function $f(x)=3x^2+11x-4$
12. What are the roots of the function $f(x)=x^3+2x^2-9x-18$?
13. Write a cubic function that has $x = 0$, $x = -2$, and $x = 5$ as zeroes.
14. Write a quadratic function that has a vertex at (2, -3) and contains the point (-2, 5).

Exponents

Simplify.

1. $\left(a^2\right)^{\frac{2}{3}}$

2. $ab^{\frac{1}{2}} \cdot a^{\frac{2}{3}}b$

3. $\dfrac{3a^2b^6}{6ab^8}$

4. $\dfrac{a^{\frac{3}{5}}}{a^{\frac{1}{2}}}$

5. $\left(3xy^{-2}\right)^{-3}$

6. $\dfrac{\left(4x^2\right)^3}{x^{-7}}$

7. $3a^{\frac{1}{2}}b^{\frac{3}{2}} \cdot 2a^{\frac{3}{2}}b^{\frac{5}{2}}$

8. $\left(\dfrac{2x^2y^{-5}}{3x^{-3}y^6}\right)^{-3}$

Evaluate.

9. $8^{\frac{1}{6}} \cdot 8^{\frac{1}{2}}$

10. $3^{\frac{1}{3}} \cdot 3^{\frac{2}{3}}$

Simplify. Assume all variables represent positive numbers.

11. $\sqrt{a} \cdot \sqrt[3]{a^2}$

12. $\sqrt[3]{a} \cdot \sqrt[5]{b}$

13. $\sqrt[3]{a} \cdot \sqrt[3]{a^2}$

14. $\sqrt{2a^2b} \cdot \sqrt{8a^4b}$

15. $\sqrt[4]{4a^2b^5} \cdot \sqrt[4]{4a^5b^3}$

16. $\sqrt[3]{x} \cdot \sqrt[4]{x}$

17. Rewrite using exponential notation.
    a. $4^2 = 16$ b. $x^2 = 5$ c. $M^x = y$

18. Rewrite using exponential notation.
    a. $\log_{10} 100 = 2$ b. $\log_3\left(\dfrac{1}{3}\right) = -1$ c. $\log_x R = y$

19. Evaluate: $\log_2\left(\dfrac{1}{4}\right)$

Express in terms of logarithms.

20. $\log_a \dfrac{x^2 y}{\sqrt[3]{z}}$

21. $\log_2 \sqrt{\dfrac{a^6 b^4}{z}}$

Express as a single logarithm.

22. $\dfrac{1}{2}\log_b x - \log_b y - \log_b z$

23. $\dfrac{1}{3}\log_b x - \dfrac{2}{3}\log_b y$

24. $2\log_{10} 3 + 4\log_{10} y - 6\log_{10} z - 8\log_{10} t$

Complex Numbers.

1. Simplify the following to *i, -i,* 1, or –1.
   a. i^2
   b. i^8
   c. i^{42}
   d. i^{103}
   e. i^{218}
   f. i^{1001}

2. Add the following and write your answer in $a+bi$ form.
   a. $(2-3i)+(5+6i)$
   b. $(7-i)+(3-4i)$
   c. $(1+i)+(3+5i)$
   d. $(8+9i)+(11-13i)$

3. Subtract the following and write your answer in $a+bi$ form.
   a. $(2-3i)-(5+6i)$
   b. $(3-4i)-(7-i)$
   c. $(3+i)-(1+5i)$
   d. $(13+8i)-(9-11i)$

4. Multiply the following and write your answer in $a+bi$ form.
   a. $3i \cdot 4$
   b. $2i \cdot 5i$
   c. $7i(2-5i)$
   d. $2i(1+i)$
   e. $(1+2i)(3+4i)$
   f. $(2-3i)(-1+i)$
   g. $(1-i)(-1+i)$
   h. $(2-i)^3$

5. Divide the following and write your answer in $a+bi$ form.
   a. $\dfrac{2}{3i}$
   b. $\dfrac{2}{i}$
   c. $\dfrac{1}{1+i}$
   d. $\dfrac{6}{2-3i}$
   e. $\dfrac{1+i}{1-i}$
   f. $\dfrac{3-5i}{4+3i}$

6. Solve the following for x over the complex number system:
   a. $x^2 + 25 = 0$
   b. $x^2 + 10 = 3x$
   c. $x^2 = 2x - 4$
   d. $x^2 = -12$

Miscellaneous Problems.

1. Give the entry in the first row and first column for: $\begin{bmatrix} 8 & -2 \\ 3 & 7 \\ -5 & 0 \end{bmatrix} + 5 \begin{bmatrix} -3 & 4 \\ 0 & 3 \\ -2 & 6 \end{bmatrix}$

2. Give entry in the second row and first column for: $\begin{bmatrix} 3 & 4 \\ -2 & 5 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 2 & 3 \\ 5 & 6 \end{bmatrix}$

3. Evaluate $\begin{vmatrix} 12 & -9 \\ -3 & 5 \end{vmatrix}$

4. Evaluate $\begin{vmatrix} -3 & 1 & 2 \\ -5 & 6 & 0 \\ -2 & 3 & -1 \end{vmatrix}$

5. Give the z-value of the solution to the following system:
$$\begin{aligned} 4x - 5y &= 11 \\ 2x + z &= 7 \\ 2y + z &= 1 \end{aligned}$$

6. If $S = \dfrac{a}{1-r}$ then r =?

7. If $\begin{bmatrix} 2 & 3 \\ 5 & 6 \end{bmatrix} \begin{bmatrix} k & 1 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 4 & 8 \\ 10 & 17 \end{bmatrix}$, then k =?

8. If $\begin{vmatrix} k & 1 \\ 0 & 2 \end{vmatrix} = 10$, then k =?

9. In the list $-\frac{1}{2}, \sqrt{7}, \sqrt{25}, \pi, \frac{0}{8}, 16.2, \frac{3}{5}, 12,$ the sum of all the rational numbers is:

10. How many integers are in the list: $-\frac{1}{2}, \sqrt{7}, \sqrt{25}, \pi, \frac{0}{8}, 16.2, \frac{3}{5}, 12$?

ANSWERS

Functions Answers:

1.

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

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

$= 3(4) + 4 + 4$

$= 12 + 4 + 4$

$= 20$

2. $f(x) = 3x - 2$ and $g(x) = x^2 - 4x + 1$

a. $(f + g)(x)$:

$$\begin{array}{r} 3x - 2 \\ x^2 - 4x + 1 \\ \hline x^2 - x - 1 \end{array}$$

b. $(f - g)(x)$:

$$\begin{array}{r} 3x - 2 \\ -(x^2 - 4x + 1) \\ \hline -x^2 + 7x - 3 \end{array}$$

c. $(fg)(x) = (3x - 2)(x^2 - 4x + 1) =$ $3x(x^2 - 4x + 1) - 2(x^2 - 4x + 1)$

$3x^3 - 12x^2 + 3x - 2x^2 + 8x - 2$

$3x^3 - 14x^2 + 11x - 2$

d. $\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)} = \frac{3x - 2}{x^2 - 4x + 1}$

e. $(f \circ g)(x) = f(g(x)) =$ $3(x^2 - 4x + 1) - 2$

$3x^2 - 12x + 3 - 2$

$3x^2 - 12x + 1$

f. $(g \circ f)(x) = g(f(x)) =$ $(3x - 2)^2 - 4(3x - 2) + 1$

$(3x - 2)(3x - 2) - 4(3x - 2) + 1$

$9x^2 - 6x - 6x + 4 - 12x + 8 + 1$

$9x^2 - 24x + 13$

g. $f(g(2))$: from earlier $f(g(x)) = 3x^2 - 12x + 1$

So $f(g(2)) =$ $3(2)^2 - 12(2) + 1$

$3(4) - 24 + 1$

$12 - 24 + 1$

-11

3. $f(x)=2x-3$ find $f^{-1}(x)$

$f(x)=y=2x-3$ $\qquad f^{-1}(x)=$

$$x=2y-3$$
$$x+3=2y-3+3$$
$$x+3=2y$$
$$y=\frac{x+3}{2}$$

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

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

$$x=\sqrt[3]{4y+1}$$
$$x^3=4y+1$$
$$x^3-1=4y+1-1$$
$$x^3-1=4y$$
$$y=\frac{x^3-1}{4}$$

5. If f(x) contains the point (4, 1), then $f^{-1}(x)$ must contain what point?

Substitute x for y and y for x $\qquad$ (1, 4)

6. **a.** $(-\infty,\infty)$

b. $4x-9\neq 0$ $\qquad 4x-9+9\neq 0+9$

$$\frac{4x}{4}\neq\frac{9}{4}$$
$$x\neq\frac{9}{4}$$
$$\left(-\infty,\frac{9}{4}\right)\cup\left(\frac{9}{4},\infty\right)$$

c. $x^2-2x-8\neq 0$

$(x+2)(x-4)\neq 0$

$x+2\neq 0$	$x-4\neq 0$
$x+2-2\neq 0-2$	$x-4+4\neq 0+4$
$x\neq -2$	$x\neq 4$

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

d. $3x+7\geq 0$ $\qquad 3x+7-7\geq 0-7$

$$\frac{3x}{3}\geq\frac{-7}{3}$$
$$x\geq\frac{-7}{3}$$
$$\left[\frac{-7}{3},\infty\right]$$

7. If $\frac{(2x^2+kx+3)}{(x-3)} = 2x-1$, then find the value of k.

$$2x^2+kx+3=(2x-1)(x-3)$$
$$2x^2+kx+3=2x^2-6x-x+3$$
$$2x^2+kx+3+2x^2-7x+3$$
$$k=-7$$

8. If $x=4y+1$ and $z=3x-5$, find an expression for z in terms of y.

$$z(x(y))= \quad 3(4y+1)-5$$
$$12y+3-5$$
$$12y-2$$

9. $f(x)=3x^2+6x-5$

$$=(3x^2+6x)-5$$
$$=3(x^2+2x)-5$$
$$=3(x^2+2x+1)-5-3$$
$$=3(x+1)^2-8$$

Vertex: (-1, -8)

10. $f(x)=2x^2-8x+3$

$$\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{-(-8)\pm\sqrt{64-4(2)(3)}}{2(2)}$$
$$=\frac{8\pm\sqrt{64-24}}{4}=\frac{8\pm\sqrt{40}}{4}$$
$$=\frac{8\pm2\sqrt{10}}{4}=\frac{4\pm\sqrt{10}}{2}$$

11. $f(x)=3x^2+11x-4$

$$=(3x-1)(x+4)$$

$3x-1=0$ | $x+4=0$
$3x-1+1=0+1$ | $x+4-4=0-4$
$3x=1$ | $x=-4$
$x=\frac{1}{3}$

12. $f(x)=x^3+2x^2-9x-18$

$$=x^2(x+2)-9(x+2)$$
$$=(x^2-9)(x+2)$$
$$=(x+3)(x-3)(x+2)$$

x= -3, 3, -2

13. $x(x+2)(x-5)=0$

$x(x^2-3x-10)=0$

$=x^3-3x^2-10x=0$

14. $f(x)=a(x-4)^2+k$

$5=a(-2-2))^2-3$

$5=a(16)-3$

$a=\frac{1}{2}$

$f(x)=\frac{1}{2}(x-2)^2-3$

$=\frac{1}{2}(x^2-4x+4)-3$

$=\frac{1}{2}x^2-2x+2-3$

$f(x)=\frac{1}{2}x^2-2x-1$

Exponents – Answers:

1. $(a^2)^{\frac{2}{3}}=a^{2\cdot\frac{2}{3}}=a^{\frac{4}{3}}$

2. $ab^{\frac{1}{2}}\cdot a^{\frac{2}{3}}b=a^{1+\frac{2}{3}}b^{\frac{1}{2}+1}=a^{\frac{3}{2}+\frac{2}{3}}b^{\frac{1}{2}+\frac{2}{2}}=a^{\frac{5}{3}}b^{\frac{3}{2}}$

3. $\frac{3a^2b^6}{6ab^8}=\frac{1a^{2-1}b^{6-8}}{2}=\frac{a^1b^{-2}}{2}=\frac{a}{2b^2}$

4. $\frac{a^{\frac{3}{5}}}{a^{\frac{1}{2}}}=a^{\frac{3}{5}-\frac{1}{2}}=a^{\frac{6}{10}-\frac{5}{10}}=a^{\frac{1}{10}}$

5. $(3xy^{-2})^{-3}=3^{-3}x^{-3}y^{-2(-3)}=\frac{y^6}{3^3x^3}=\frac{y^6}{27x^3}$

6. $\frac{(4x^2)^3}{x^{-7}}=\frac{64x^{2(3)}}{x^{-7}}=64x^6\cdot x^7=64x^{(6+7)}=64x^{13}$

7. $3a^{\frac{1}{2}}b^{\frac{3}{2}}\cdot 2a^{\frac{3}{2}}b^{\frac{5}{2}}=3(2)a^{\frac{1}{2}+\frac{3}{2}}b^{\frac{3}{2}+\frac{5}{2}}=6a^{\frac{4}{2}}b^{\frac{8}{2}}=6a^2b^4$

8. $\left(\frac{2x^2y^{-5}}{3x^{-3}y^6}\right)^{-3}=\frac{2^{-3}x^{2(-3)}y^{-5(-3)}}{3^{-3}x^{-3(-3)}y^{6(-3)}}=\frac{3^3x^{-6}y^{15}}{2^3x^9y^{-18}}=\frac{27y^{15}y^{18}}{8x^9x^6}=\frac{27y^{(15+18)}}{8x^{(9+6)}}=\frac{27y^{33}}{8x^{15}}$

9. $8^{\frac{1}{6}}\cdot 8^{\frac{1}{2}}=8^{\frac{1}{6}+\frac{1}{2}}=8^{\frac{2}{12}+\frac{6}{12}}=8^{\frac{8}{12}}=8^{\frac{2}{3}}=\sqrt[3]{8^2}=\sqrt[3]{64}=4$

10. $3^{\frac{1}{3}} \cdot 3^{\frac{2}{3}} = 3^{\frac{1}{2}+\frac{2}{3}} = 3^{\frac{3}{3}} = 3^1 = 3$

11. $\sqrt{a} \cdot \sqrt[3]{a^2} = a^{\frac{1}{2}} \cdot a^{\frac{2}{3}} = a^{\left(\frac{1}{2}+\frac{2}{3}\right)} = a^{\frac{3}{6}+\frac{4}{6}} = a^{\frac{7}{6}} = a^{\frac{6}{6}} a^{\frac{1}{6}} = a^1 a^{\frac{1}{6}} = a\sqrt[6]{a}$

12. $\sqrt[3]{a}\sqrt[5]{b} = a^{\frac{1}{3}} b^{\frac{1}{5}} = a^{\frac{5}{15}} b^{\frac{3}{15}} = \sqrt[15]{a^5 b^3}$

13. $\sqrt[3]{a} \cdot \sqrt[3]{a^2} = a^{\frac{1}{3}} \cdot a^{\frac{2}{3}} = a^{\left(\frac{1}{3}+\frac{2}{3}\right)} = a^{\frac{3}{3}} = a^1 = a$

14. $\sqrt{2a^2 b} \cdot \sqrt{8a^4 b} = \sqrt{2(8)a^2 a^4 bb} = \sqrt{16a^6 b^2} = 4a^3 b$

15. $\sqrt[4]{4a^2 b^5}\sqrt[4]{4a^5 b^3} = \sqrt[4]{4(4)a^2 a^5 b^5 b^3} = \sqrt[4]{16a^7 b^8} = 2ab^2\sqrt[4]{a^3}$

16. $\sqrt[3]{x} \cdot \sqrt[4]{x} = x^{\frac{1}{2}} x^{\frac{1}{4}} = x^{\frac{4}{12}} x^{\frac{3}{12}} = x^{\frac{7}{12}} = \sqrt[12]{x^7}$

17.
    a. $\log_4 16 = 2$
    b. $\log_x 5 = 2$
    c. $\log_M y = x$

18.
    a. $10^2 = 100$
    b. $3^{-1} = \frac{1}{3}$
    c. $x^y = R$

19. $\log_2\left(\frac{1}{4}\right) \rightarrow 2^x = \frac{1}{4}$ x = -2

20. $2\log_a x + \log_a y - \frac{1}{3}\log_a z$

21. $3\log_2 a + 2\log_2 a - \frac{1}{2}\log_2 2$

22. $\log_b x^{\frac{1}{2}} - \log_b y - \log_b z = \log_b\left(\frac{\sqrt{x}}{yz}\right)$

23. $\log_b x^{\frac{1}{3}} - \log_b y^{\frac{2}{3}} = \log_b\left[\frac{\sqrt[3]{x}}{\left(\sqrt[3]{y}\right)^2}\right]$

24. $\log_{10}\left[\frac{3^2 y^4}{z^6 t^8}\right] = \log_{10}\left[\frac{9y^4}{z^6 t^8}\right]$

Complex Numbers – Answers.

1. a. -1
   b. 1
   c. -1
   d. $-i$
   e. -1
   f. –1

2. a. $7+3i$
   b. $4+6i$
   c. $10-5i$
   d. $19-4i$

3. a. $-3-9i$
   b. $-4-3i$
   c. $2-4i$
   d. $4+19i$

4. a. $12i$
   b. -10
   c. $35 + 14i$
   d. $-2 + 2i$
   e. $-5+10i$
   f. $1 + 5i$
   g. $2i$
   h. $(2-i)(2-i)(2-i)$
      $(4-4i+i^2)(2-i)$
      $(3-4i)(2-i)$
      $6-3i-8i\_4i^2$
      $2-11i$

5. a. $\frac{2}{3i}\cdot\frac{i}{i} = -\frac{2}{3}i$

   b. $\frac{2}{i} - \frac{i}{i} = -2i$

   c. $\frac{1}{1+i}\cdot\frac{(1-i)}{(1-i)} = \frac{1-i}{1-i^2} = \frac{1-i}{2}$

   d. $\frac{6}{2-3i}\cdot\frac{(2+3i)}{(2+3i)} = \frac{12+18i}{4-9i^2} = \frac{12+18i}{13}$

   e. $\frac{(1+i)}{(1-i)}\cdot\frac{(1+i)}{(1+i)} = \frac{1+2i+i^2}{1+1} = \frac{2i}{2} = i$

f. $\dfrac{3-5i}{4+3i}\cdot\dfrac{(4-3i)}{(4-3i)}=\dfrac{12-9i-20i+15i^2}{16-9i^2}=\dfrac{-3-29i}{25}$

6. a. $x^2+25=0$
$x^2=25$
$x=\pm\sqrt{-25}=\pm 5i$

b. $x^2+10=3x$
$x^2-3x+10=0$
$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}=\dfrac{3\pm\sqrt{9-40}}{2}=\dfrac{3\pm\sqrt{31i}}{2}$

c. $x^2=2x-4$
$x^2-2x+4=0$
$x=\dfrac{-b\pm\sqrt{b^2-4ac}}{2a}=\dfrac{2\pm\sqrt{4-16}}{2}=\dfrac{2\pm 2\sqrt{3i}}{2}=1\pm\sqrt{3i}$

d. $x^2=-12$
$x=\pm\sqrt{-12}=\pm 2\sqrt{3i}$

Miscellaneous Problems – Answers.

1. $\begin{bmatrix}8 & -2\\ 3 & 7\\ -5 & 0\end{bmatrix}+5\begin{bmatrix}-3 & 4\\ 0 & 3\\ -2 & 6\end{bmatrix}=\begin{bmatrix}8 & -2\\ 3 & 7\\ -5 & 0\end{bmatrix}+\begin{bmatrix}-15 & 20\\ 0 & 15\\ -10 & 30\end{bmatrix}=\begin{bmatrix}-7 & 18\\ 3 & 22\\ -15 & 30\end{bmatrix}=$ -7

2. $\begin{bmatrix}3 & 4\\ -2 & 5\\ 0 & 3\end{bmatrix}\begin{bmatrix}2 & 3\\ 5 & 6\end{bmatrix}=\begin{bmatrix}26 & 33\\ 21 & 24\\ 15 & 18\end{bmatrix}=21$

3. $\begin{vmatrix}12 & -9\\ -3 & 5\end{vmatrix}=(12\cdot 5)-(-9\cdot -3)=60-27=33$

4. $\begin{vmatrix}-3 & 1 & 2\\ -5 & 6 & 0\\ -2 & 3 & -1\end{vmatrix}$
$=2[(1-5)(3)-6(-2)]-0[-3(3)-1(-2)]-1[(-3)(-6)-1(-5)]$
$=2(-15+12)-(-18+5)=2(-3)-(-13)$
$=-6+13=7$

5. $4x-5y=11$
$2x+z=7$
$2y+z=1$

$$\begin{array}{rrrr} 4x-5y=11 & -5y-2z=-3 & -5(1)-2z=-3 & 4x-5(1)=11 \\ +\ \underline{-4x-2z=-14} & +\ \underline{4y+2z=2} & -5-2z=-3 & 4x-5=11 \\ -5y-2z=-3 & -1y=-1 & -2z=2 & 4x=16 \\ & y=1 & z=-1 & x=4 \end{array}$$

6. $s=\dfrac{a}{1-r}$ $\qquad 1-r=\dfrac{a}{s}$

-1 -1

$$-r=\frac{a}{s}-1$$

$$r=1-\frac{a}{s}=\frac{s}{s}-\frac{a}{s}=\frac{s-a}{s}$$

$$r=\frac{s-a}{s}$$

7. $2k+3\cdot 0=4$
$2k=4$
$k=2$

8. $\begin{vmatrix} k & 1 \\ 0 & 2 \end{vmatrix}=10$

$k\cdot 2+0\cdot 1=10$
$2k=10$
$k=5$

9. $-0.5+5+0+16.2+0.6+12=33.3$

10. $\sqrt{25}=5$ $\qquad \dfrac{0}{8}=0$ $\qquad 12=12$