## Chapter 0 Multiple-Choice Review Exercises

**Directions**: These review exercises are multiple-choice questions based on the content in Chapter 0: Preliminaries.

**0.1**: Fundamental Skills in Algebra
**0.2**: Numbers, Sets, and Absolute Values
**0.3**: Coordinates and Geometry
**0.4**: Defining a Function
**0.5**: Linear Functions and Equations
**0.6**: Modifying Functions; Inverse Functions
**0.7**: Quadratics
**0.8**: Trigonometry
**0.9**: Exponents and Logarithms
**0.10**: Sigma Notation

For each question, select the best answer provided. To make the best use of these review exercises, follow these guidelines:

- Print out this document and work through the questions as if this paper were an exam.
- Do not use a calculator of any kind. All of these problems are designed to contain simple numbers.
- Try to spend no more than three minutes on each question. Work as quickly as possible without sacrificing accuracy.
- Do your figuring in the margins provided. If you encounter difficulties with a question, then move on and return to it later.
- After you complete all the questions, compare your responses to the answer key on the last page. Note any topics that require revision.

## Preliminaries

### Number of Questions—60

NO CALCULATOR

**1.** A line connects the points $(0,1)$ and $(1,5)$. Its slope is

(A) $-4$ (B) $-1$ (C) $1$ (D) $4$ (E) $5$

**2.** The function $ax^2+2x+c$ is rewritten in the form $a(x-h)^2+k$, where $h$ and $k$ are constants. What is the value of $k$ ?

(A) $\dfrac{1}{2a^2}$ (B) $\dfrac{1}{a^2}$ (C) $\dfrac{ac-1}{a}$ (D) $\dfrac{a^2c-1}{a}$ (E) $\dfrac{1-ac}{a}$

**3.** $\dfrac{x-2}{x+4} > 0$ if

(A) $x < -4$

(B) $-4 < x < 2$

(C) $-4 < x \leqslant 2$

(D) $x > 2$

(E) $x < -4, x > 2$

**4.** The domain of $e^{\sqrt{x-2}} - 6$ is

(A) $x \geqslant -6$

(B) $x \geqslant 0$

(C) $x \leqslant 2$

(D) $x \geqslant 2$

(E) all real numbers

**5.** For $\pi < \theta < \dfrac{3\pi}{2}$, $\cos\theta = -\dfrac{1}{5}$. Then $\sin\theta =$

(A) $-\dfrac{\sqrt{24}}{5}$ (B) $-\dfrac{4}{5}$ (C) $\dfrac{1}{5}$ (D) $\dfrac{4}{5}$ (E) $\dfrac{\sqrt{24}}{5}$

**6.** What is the solution set of $x$ in the following system of equations?

$$y = 5x - 3$$
$$y = x^2 + 1$$

(A) $\{-17, -2\}$

(B) $\{-4, -1\}$

(C) $\{1, 4\}$

(D) $\{2, 17\}$

(E) $\{4\}$

**7.** If $f(x) = x^3 - 4$, then $f^{-1}(x) =$

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

(B) $f^{-1}(x) = \dfrac{1}{x^3-4}$

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

(D) $f^{-1}(x) = \sqrt[3]{x^3-8}$

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

**8.** A man stands 50 feet from a building that is 200 feet tall. The angle between the man and the top of the building is

(A) $\tan^{-1}(4)$ (B) $\tan^{-1}\left(\dfrac{1}{4}\right)$ (C) $\sin^{-1}(4)$ (D) $\sin^{-1}\left(\dfrac{1}{4}\right)$ (E) $\cos^{-1}(4)$

**9.** The horizontal asymptote of $f(x) = \dfrac{2x^3 + 8x^2 - 6x}{4 + 8x^3} + 1$ is

(A) $y = 0$ (B) $y = \dfrac{1}{4}$ (C) $y = 1$ (D) $y = \dfrac{5}{4}$ (E) $y = 2$

**10.** Which transformation must be performed to $f(x)$ to obtain the new function $g(x) = 3f(2x-4)+7$ ?

(A) $f(x)$ must be shifted 2 units to the left.

(B) $f(x)$ must be shifted 2 units to the right.

(C) $f(x)$ must be shifted 4 units to the left.

(D) $f(x)$ must be shifted 4 units to the right.

(E) $f(x)$ must be shifted down 7 units.

**11.** $\cos\left(\frac{3\pi}{4}\right)$ is

(A) $-\frac{\sqrt{3}}{2}$ (B) $-\frac{\sqrt{2}}{2}$ (C) $-\frac{1}{2}$ (D) $\frac{1}{2}$ (E) $\frac{\sqrt{2}}{2}$

**12.** The slope of $x-2y=3$ is

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

**13.** Which statement is true about $f(x) = x^2 - 4x + 5$ ?

(A) $f(x)$ has a minimum at $(-2, 1)$.

(B) $f(x)$ has a maximum at $(-2, 1)$.

(C) $f(x)$ has a minimum at $(2, 1)$.

(D) $f(x)$ has a maximum at $(2, 1)$.

(E) $f(x)$ has a minimum at $(4, 5)$.

**14.** Which function has a vertical asymptote at $x = 1$ ?

(A) $f(x) = \dfrac{1}{x^2 - 3x + 2}$

(B) $f(x) = \sqrt{x - 1}$

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

(D) $f(x) = \dfrac{x - 1}{x + 1}$

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

**15.** Which expression is equivalent to $\left(4w^2x^8y^{-2}\sqrt{z}\right)^{-1/2}$ ?

(A) $\dfrac{2wx^4\sqrt[4]{z}}{y}$ (B) $\dfrac{y}{2wx^4\sqrt[4]{z}}$ (C) $\dfrac{2y}{wx^4\sqrt[4]{z}}$ (D) $\dfrac{wx^4\sqrt[4]{z}}{2y}$ (E) $\dfrac{2wx^4}{y^2\sqrt{z}}$

**16.** $\dfrac{2x^2-5x+9}{x-1}=$

(A) $2x^2-3x+6$

(B) $2x-3+\dfrac{6}{x-1}$

(C) $2x^2-3x+\dfrac{6}{x-1}$

(D) $2x-3$

(E) $2x-7+\dfrac{2}{x-1}$

**17.** Assuming that the domains are restricted to avoid division by zero, $\dfrac{x^2-10x+24}{x-3}\cdot\dfrac{2(x-6)^{-1}}{x-4}=$

(A) $\dfrac{2(x-4)}{x-3}$

(B) $\dfrac{2}{x-3}$

(C) $\dfrac{2}{(x-3)(x-6)}$

(D) $\dfrac{2(x-6)(x-4)}{x-3}$

(E) $\dfrac{2}{x-4}$

**18.** The domain of $g(x)=\dfrac{\log_2(x)}{x-5}$ is

(A) $x\neq 0$

(B) $x>0$

(C) $x\neq 5$

(D) $x>0, x\neq 5$

(E) all real numbers

**19.** Which option best describes the end behavior of $f(x) = e^{-2x} - 2$ ?

(A) As $x \to \infty, f(x) \to -\infty$.

(B) As $x \to \infty, f(x) \to -2$.

(C) As $x \to \infty, f(x) \to 0$.

(D) As $x \to \infty, f(x) \to 1$.

(E) As $x \to \infty, f(x) \to \infty$.

**20.** $\dfrac{\sin^8(x) - \cos^8(x)}{\sin^4(x) + \cos^4(x)} =$

(A) $\dfrac{1}{2}$

(B) $1$

(C) $\sin^2(x) - \cos^2(x)$

(D) $\sin^4(x) + \cos^4(x)$

(E) $\cos^2(x) - \sin^2(x)$

**21.** The period of $7\sin\left(3x-\frac{\pi}{4}\right)-2$ is

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\pi$ (D) $2\pi$ (E) $4\pi$

**22.** $\log(12)=$

(A) $2\log 6$

(B) $3\log 4$

(C) $\log(4)+\log(3)$

(D) $\log(12)\log(1)$

(E) $\log(6)\log(2)$

**23.** If $a = be^{cd}$, then $d =$

(A) $\dfrac{\ln(b) - \ln(a)}{c}$

(B) $\dfrac{\ln a}{c \ln b}$

(C) $\sqrt[c]{\dfrac{a}{b}}$

(D) $\dfrac{1}{c} e^{a/b}$

(E) $\dfrac{\ln(a) - \ln(b)}{c}$

**24.** $\sqrt{a} + \sqrt{b} =$

(A) $\sqrt{a+b}$

(B) $\sqrt{a-b}$

(C) $\sqrt{ab}$

(D) $a\sqrt{b}$

(E) None of the above

**25.** What are the solutions to the equation $\dfrac{x^2-5x-24}{x-8}=2x-5$ ?

(A) $x=-3$

(B) $x=\dfrac{5}{2}$

(C) $x=8$

(D) $x=-3, x=8$

(E) The equation has no solution.

**26.** $4^a\,\dfrac{2^{3b-1}}{8^{1-c}}=$

(A) $2^{a+3b+c-2}$

(B) $2^{a+3b-c}$

(C) $2^{2a+3b-3c+2}$

(D) $2^{2a+3b+3c-4}$

(E) $2^{a(3b-1)/(1-c)}$

**27.** Which function does *not* have all real numbers as its range?

(A) $y = 3x$

(B) $y = 4x^3 - 8x^2 + x - 17$

(C) $y = \log_4(x+2)$

(D) $y = \dfrac{x^2 - 3x - 10}{x+2}$

(E) $y = \dfrac{e^x}{x-3}$

**28.** What values of $x$ satisfy $\ln(x-3) + \ln(x+1) = \ln(5)$ ?

(A) $x = -4, x = 2$

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

(C) $x = -2$

(D) $x = 2, x = 4$

(E) $x = 4$

**29.** What is an equation of the line that passes through the point $(-2,1)$ and has a slope of $-\frac{1}{2}$ ?

(A) $y+1=-\frac{1}{2}(x-2)$

(B) $y+1=-\frac{1}{2}(x+2)$

(C) $y-1=-\frac{1}{2}(x+2)$

(D) $y+1=\frac{1}{2}(x-2)$

(E) $y-1=\frac{1}{2}(x+2)$

**30.** The solution set of $x$ in $\frac{3}{x-1}=\frac{x-2}{2}$ is

(A) $\{-4,1\}$ (B) $\left\{-\frac{3}{2},1\right\}$ (C) $\{-1,4\}$ (D) $\{-1\}$ (E) $\{4\}$

**31.** The range of $-3\cos\left(4x-\dfrac{\pi}{3}\right)+7$ is

(A) $[-4,10]$ (B) $[-3,3]$ (C) $[4,10]$ (D) $[5,11]$ (E) $[11,15]$

**32.** A downward-opening parabola intersects the $y$-axis at $(0,30)$ and has zeros of $x=-2$ and $x=5$. The parabola's equation is

(A) $y=(x-2)(x-5)$

(B) $y=(x+2)(x+5)$

(C) $y=3(x-2)(x-5)$

(D) $y=-3(x+2)(x+5)$

(E) $y=-3(x-2)(x-5)$

**33.** $\cos\left(\tan^{-1} x\right) =$

(A) $\dfrac{x}{\sqrt{1+x^2}}$ (B) $x$ (C) $\dfrac{1}{\sqrt{1+x^2}}$ (D) $\dfrac{1}{\sqrt{1-x^2}}$ (E) $\dfrac{\sqrt{1+x^2}}{x}$

**34.** Which function does *not* have all real numbers as its domain?

(A) $y = \dfrac{x^2}{x}$

(B) $y = 2^x$

(C) $y = -3\sin(x-4)+9$

(D) $y = |x-4|-2$

(E) $y = -7$

**35.** If $f(x) = x^2 - 4$ and $g(x) = \sin^2(x-3)$, then $g(f(x)) =$

(A) $\sin^4(x-3) - 4$

(B) $\sin^2(x^2-7)$

(C) $\sin^4(x-3) - 4\sin^2(x-3)$

(D) $\sin^2(x^2-x-7)$

(E) $\sin^2(x^2-4)$

**36.** What value of $x$ satisfies $2^{3x-1} = 8^{4x-2}$ ?

(A) $\log_2\left(\frac{1}{5}\right)$ (B) $\log_2\left(\frac{5}{9}\right)$ (C) $\frac{1}{5}$ (D) $\frac{5}{9}$ (E) $1$

**37.** An object's kinetic energy varies directly as the square of the object's speed. A cannonball traveling at 5 meters per second has a kinetic energy of 100 joules. How much kinetic energy would the cannonball have if it traveled at 10 meters per second?

(A) 40 joules (B) 100 joules (C) 200 joules (D) 400 joules (E) 2000 joules

**38.** Polynomial $f(x)$ contains the distinct factor $(x-p)^2$. Which statement describes the behavior of $f(x)$ at $x = p$ ?

(A) $f(x)$ intersects the $x$-axis at $x = p$.

(B) $f(x)$ curves through the $x$-axis at $x = p$.

(C) $f(x)$ bounces off the $x$-axis at $x = p$.

(D) $f(x)$ does not touch the $x$-axis at $x = p$.

(E) $f(x)$ is undefined at $x = p$.

**39.** $f(x) = \log_3(\sqrt[3]{x-p})$ is undefined for

(A) $p \leqslant 0$ (B) $p \geqslant 0$ (C) $p = x$ (D) $p \leqslant x$ (E) $p \geqslant x$

**40.** Which statement describes the end behavior of $f(x) = x^6 + 2x^5 - x^2 + 4$ ?

(A) As $x \to -\infty$, $f(x) \to 0$; as $x \to \infty$, $f(x) \to 0$.

(B) As $x \to -\infty$, $f(x) \to -\infty$; as $x \to \infty$, $f(x) \to -\infty$.

(C) As $x \to -\infty$, $f(x) \to -\infty$; as $x \to \infty$, $f(x) \to \infty$.

(D) As $x \to -\infty$, $f(x) \to \infty$; as $x \to \infty$, $f(x) - \to \infty$.

(E) As $x \to -\infty$, $f(x) \to \infty$; as $x \to \infty$, $f(x) \to \infty$.

**41.** $\sum_{i=1}^{5}(2i-1) =$

(A) 8 (B) 20 (C) 25 (D) 30 (E) 125

**42.** The range of $\dfrac{2}{5-x} - 1$ is

(A) all real numbers

(B) $x > -1$

(C) $x > -\dfrac{3}{5}$

(D) $x \neq 0$

(E) $x \neq 5$

**43.** What are the solutions to $|x-4|+2=5$ ?

(A) $x=-1$

(B) $x=3$

(C) $x=7$

(D) $x=-1, x=7$

(E) $x=1, x=7$

**44.** $\sec\left(\frac{\pi}{2}\right)$ is

(A) $-1$ (B) $0$ (C) $1$ (D) $\pi$ (E) undefined

**45.** Which expression is equivalent to $\frac{1}{a}+\frac{1}{b}$ ?

(A) $\frac{a+b}{ab}$ (B) $\frac{1}{a+b}$ (C) $\frac{1}{ab}$ (D) $\frac{ab}{a+b}$ (E) $\frac{2}{a+b}$

**46.** Which expression is equivalent to $\left(4a^4b^3c^{-7}d^{-5}\right)^2$ ?

(A) $16a^8b^6c^{-14}d^{-10}$

(B) $\frac{a^4b^3}{16c^7d^5}$

(C) $\frac{c^{14}}{16a^8b^6}$

(D) $\frac{a^2b}{16c^9d^7}$

(E) $\frac{16c^9d^7}{a^2b}$

**47.** A sphere with radius $r$ has a volume of $\frac{4}{3}\pi r^3$ and a surface area of $4\pi r^2$. A spherical ball has a surface area of $400\pi$ square meters. Its volume, in cubic meters, is

(A) 10 (B) $\frac{40\pi}{3}$ (C) 1000 (D) $\frac{400\pi}{3}$ (E) $\frac{4000\pi}{3}$

**48.** $\sin^{-1}\left(\sin\frac{2\pi}{3}\right) =$

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$ (C) $\frac{2\pi}{3}$ (D) $\frac{1}{2}$ (E) $\frac{\sqrt{3}}{2}$

**49.** Which expression is equivalent to $e^{f(x)}$ ? (Note: $\log x = \log_{10} x$.)

(A) $10^{f(x)\log e}$

(B) $10^{f(x)+\log e}$

(C) $10^{f(x)\ln 10}$

(D) $10^{f(x)-\log e}$

(E) $10^{f(x)+\ln 10}$

**50.** $2x^2 - kx + 8$ has no real solutions for

(A) $-8 < k, k > 8$

(B) $k < -\sqrt{2}, k > \sqrt{2}$

(C) $-8 < k < 8$

(D) $-2\sqrt{2} < k < 2\sqrt{2}$

(E) $k < 64$

**51.** If $f(x) = x^2 + 4$, then $\dfrac{f(x+h) - f(x)}{h} =$

(A) $2x + h$ (B) $2x + 2h$ (C) $x^2 + h$ (D) $2x + h + 4$ (E) $x^2 + h + 4$

**52.** For $0 < x < 1$, which inequality is true?

(A) $\sqrt{x} < x^2 < x$

(B) $x^2 < x < \sqrt{x}$

(C) $\sqrt{x} < x < x^2$

(D) $x^2 < \sqrt{x} < 1$

(E) $x < \sqrt{x} < x^2$

**53.** Which set of $x$ satisfies the following system of equations?

$$y = 2\sin^2 x$$
$$y - 1 = \sin x$$

(A) $\{-1, 2\}$

(B) $\left\{-\frac{1}{2}, 1\right\}$

(C) $\left\{\frac{3\pi}{2}\right\}$

(D) $\left\{\frac{\pi}{2}, \frac{7\pi}{6}\right\}$

(E) No solution exists.

**54.** If $f(x) = \cos(2x+4)$ and $g(x) = \sqrt{x-2}$, then the domain of $f(g(-2x))$ is

(A) $x \leqslant -2$

(B) $x \leqslant -1$

(C) $x \geqslant 1$

(D) $x \geqslant 2$

(E) all real numbers

**55.** What values of $x$ satisfy the inequality $x^2 - 4x + 3 > 0$ ?

(A) $-\infty < x < \infty$

(B) $1 < x < 3$

(C) $1 \leqslant x \leqslant 3$

(D) $x < 1, x > 3$

(E) $x < 1, x \geqslant 3$

**56.** Which set of $x$ satisfies $e^{2x} - 5e^x + 6 = 0$ ?

(A) $\{-\ln(3), -\ln(2)\}$

(B) $\{-\ln(2), \ln(3)\}$

(C) $\left\{-\ln\left(\frac{3}{2}\right), -\ln\left(\frac{2}{3}\right)\right\}$

(D) $\{\ln(2), \ln(3)\}$

(E) $\{2, 3\}$

**57.** Which expression is equivalent to $\sec(x) - \csc(x)$ ?

(A) $\dfrac{\cos(x) - \sin(x)}{\sin(x)\cos(x)}$

(B) $\dfrac{\sin(x)\cos(x)}{\sin(x) + \cos(x)}$

(C) $\dfrac{\sin(x) + \cos(x)}{\sin(x)\cos(x)}$

(D) $\dfrac{\sin(x) - \cos(x)}{\sin(x)\cos(x)}$

(E) $\dfrac{\sin(x) - \cos(x)}{\sin(x) + \cos(x)}$

**58.** What values of $x$ satisfy the equation $\dfrac{2}{x+4} - \dfrac{2}{x-1} = 3$ ?

(A) $x = \dfrac{9 \pm \sqrt{9^2 - 4(3)(2)}}{2(3)}$

(B) $x = \dfrac{9 \pm \sqrt{9^2 - 4(3)(2)}}{2(3)}$

(C) $x = \dfrac{9 \pm \sqrt{9^2 - 4(3)(2)}}{3}$

(D) $x = \dfrac{-9 \pm \sqrt{9^2 - 4(3)(2)}}{3}$

(E) $x = \dfrac{9 \pm \sqrt{9^2 - (3)(2)}}{3}$

**59.** Let $f$ be an invertible function. The graph of $y = g(x)$ is obtained by performing the following transformations to the graph of $y = f(x)$:

- The graph is reflected across the line $y = x$.
- The graph is then shifted 4 units to the left.
- The graph is then translated 3 units down.

Which function is $g(x)$ ?

(A) $g(x) = f(x+4) - 3$

(B) $g(x) = f(x-4) - 3$

(C) $g(x) = f^{-1}(x+4) - 3$

(D) $g(x) = f^{-1}(x-4) - 3$

(E) $g(x) = f^{-1}(x-4) + 3$

**60.** Which expression is equivalent to $\log(2w)+3\log(x)-\frac{1}{2}\log(4y)+3\log(z)$ ?

(A) $\log\left(\frac{\sqrt{y}}{wx^3z^3}\right)$

(B) $\log\left(\frac{wx^3z^3}{2\sqrt{y}}\right)$

(C) $\log\left(\frac{w\sqrt{y}}{4x^3z^3}\right)$

(D) $\log\left(\frac{wz^3}{2x^3\sqrt{y}}\right)$

(E) $\log\left(\frac{wx^3z^3}{\sqrt{y}}\right)$

*This marks the end of the review exercises. The following page contains the answers to all the questions.*

**1.** D
**2.** C
**3.** E
**4.** D
**5.** A
**6.** C
**7.** A
**8.** A
**9.** D
**10.** B
**11.** B
**12.** D
**13.** C
**14.** A
**15.** B
**16.** B
**17.** B
**18.** D
**19.** B
**20.** C
**21.** B
**22.** C
**23.** E
**24.** E
**25.** E
**26.** D
**27.** D
**28.** E
**29.** C
**30.** C
**31.** C
**32.** E
**33.** C
**34.** A
**35.** B
**36.** D
**37.** D
**38.** C
**39.** E
**40.** E
**41.** C
**42.** A
**43.** E
**44.** E
**45.** A
**46.** C
**47.** E
**48.** B
**49.** A
**50.** C
**51.** A
**52.** B
**53.** D
**54.** B
**55.** D
**56.** D
**57.** D
**58.** B
**59.** C
**60.** E