Practice Examination for the Calculus Readiness Assessment

We provide this practice examination so you can familiarize yourself with the format of the Calculus Readiness Assessment (CRA) before taking it. Please note these instructions for the CRA. The answers to the practice examination are provided at the end of this document.

The CRA is administered to help determine if your background in algebra and trigonometry is sufficient for you to proceed with calculus and, if so, which calculus sequence is best suited to your preparation.

- You do not need to take the CRA if any of the following conditions applies to you!! You may register for any mathematics course for which you have the prerequisites.
  - You have AP Credit for Math 0221 or both Math 021 and 022. See Information about Mathematics Courses for more information.
  - You have college transfer credit for any Lehigh calculus course (Math 021 or higher).
- The CRA is not a predictor of success in calculus. It only probes your understanding of algebra and trigonometry.
- If your results on CRA indicate that you are not sufficiently prepared for calculus, you will have options, as described in Information about Mathematics Courses.
- You may only take the CRA once. It is offered online to be taken during the course selection period in June or during the orientation period in August.
- You must take both parts of the CRA. The two parts probe different areas of preparation for calculus and are scored separately.
- The CRA is a timed test. You have 30 minutes for Part 1 and 10 minutes for Part 2. You may take the CRA at your convenience, but once you begin it, you must complete it in the allotted time.
- The number of correct answers is what matters. Blank answers cannot count as correct answers, but there is no penalty for wrong answers.
- You may not use a calculator, consult any book or notes, or receive assistance from any source while taking the CRA. It is very much to your disadvantage to cheat because the CRA is intended to help ensure your best placement based on a fair evaluation of your preparation. Furthermore, it is a violation of Lehigh Code of Conduct to cheat on the CRA.
- For problems involving graphs, assume the usual Cartesian coordinate system. A filled dot (•) on the graph indicates that the point is on the graph (or relation) in question, while an open dot (○) indicates that the point is not on the graph.
- You should have a pencil and paper handy before beginning the CRA.

Before beginning the CRA, you will be required to acknowledge that you have read and understood the information above and that you understand that it is a violation of the Lehigh Code of Conduct to use a calculator, consult any book or notes, or receive assistance from any source while taking the CRA.
Part 1

1. \(8^{-1/3} =\)
   - (A) \(-\frac{8}{3}\)
   - (B) 2
   - (C) \(\frac{1}{2}\)
   - (D) \(-\frac{1}{24}\)
   - (E) \(\frac{8^{-1}}{3}\)

2. Which of the following is an equation for the line which passes through the point \((0, 4)\) and is parallel to the line having equation \(y = 3x + 100\).
   - (A) \(y = 3x + 4\)
   - (B) \(y = -\frac{1}{3}x + 4\)
   - (C) \(y = 4x + 3\)
   - (D) \(y = -\frac{1}{4}x + 3\)
   - (E) \(y = 3x - 4\)

3. If \(f\) is the function whose graph is sketched to the right, then \(1 < f(x) < 2\) whenever
   - (A) \(x < 0\)
   - (B) \(0 < x < 1\)
   - (C) \(1 < x < 2\)
   - (D) \(2 < x < 3\)
   - (E) \(3 < x\)

4. \(\frac{(2/3)}{5} =\)
   - (A) \(\frac{10}{3}\)
   - (B) \(\frac{3}{10}\)
   - (C) \(\frac{2}{15}\)
   - (D) \(\frac{15}{2}\)
   - (E) \(\frac{6}{5}\)

5. The temperature of a certain oven increases by 40 percent (40%) each hour. If the current temperature is 100° (100 degrees), the temperature 2 hours from now will be
   - (A) 100.8°
   - (B) 116°
   - (C) 180°
   - (D) 196°
   - (E) 160000°

6. Find all roots of the equation \(x^2 - x = 2\).
   - (A) 2, 3
   - (B) \(\pm\sqrt{x + 2}\)
   - (C) \(1 \pm \sqrt{2}\)
   - (D) \(-1, 2\)
   - (E) There are no roots.
For Problem 7 below, remember that
- • means a point which is on the curve
- ○ means a point which is not on the curve.

7. If \( f(x) \) is the function defined by \( f(x) = \begin{cases} 2x + 3 & \text{if } x < 0 \\ x^2 & \text{if } x \geq 0 \end{cases} \) then, of the following, which best represents the graph of \( y = f(x) \)

(A) [Graph A] (B) [Graph B] (C) [Graph C]

(D) [Graph D] (E) [Graph E]

8. A closed rectangular box has a square base of side length \( x \) and the box has height \( h \). In terms of \( x \) and \( h \), the surface area is equal to

(A) \( 2x^2 + 4xh \) (B) \( x^2h \) (C) \( 4x + h \) (D) \( x^2 + 4xh \) (E) \( 8x + 4h \)
9. The y-coordinate of the point of intersection of the graphs of \(x + y = 3\) and \(x - y = 5\) is

(A) 4  (B) -4  (C) 1  (D) -1  (E) -3

10. If \((x + 1)^{1/4} = 2\), then \(x =\)

(A) -17  (B) 1  (C) \(2^{1/4} - 1\)  (D) 15  (E) \(-\frac{1}{2}\)

11. Determine which of the following best represents the graph of \(y = x^2 + 2x + 2\)

(A) 
(B) 
(C) 
(D) 
(E)
12. If \( x^{24} = 20 \), then \( x^{100} = \)
(A) 80  (B) 160  (C) 1600  (D) 16000  (E) 160000

13. \( \frac{x + (1/x)}{3 + x} = \)
(A) \( \frac{x}{3} + \frac{1}{x^2} \)  (B) \( \frac{x + 1}{4} \)  (C) \( 3x + x^2 + \frac{3}{x} + 1 \)  (D) \( \frac{2x}{3x + x^2} \)  (E) \( \frac{x^2 + 1}{3x + x^2} \)

14. \( \sqrt[3]{x^3 + x^2 + x} = \)
(A) \( x^{\sqrt[3]{x^3 + x^2 + x}} \)  (B) \( x^3 + x^2 + x \)  (C) \( x^5 \)
(D) \( x^{\sqrt[3]{x^3 + x^2 + 1}} \)  (E) \( 9x^5 + 8x^3 + 3x^2 \)

15. Of the following, which best represents the graph of \( y = 2^{-x} \)
(A)  
(B)  
(C)  
(D)  
(E)  

16. If \( \log_3(x + 3) = 2 \), then \( x = \)

(A) 6 \hspace{1cm} (B) 97 \hspace{1cm} (C) 5 \hspace{1cm} (D) 3 \hspace{1cm} (E) \frac{2}{\log_3} - 3

17. The inequality \( |x - 1| < 3 \) is equivalent to

(A) \( x < 4 \) \hspace{1cm} (B) \( -2 < x < 4 \) \hspace{1cm} (C) \( x < 2 \) \hspace{1cm} (D) \( x < -2 \) or \( x > 4 \) \hspace{1cm} (E) \( 2 < x < 4 \)

18. If \( f(x) = x^2 \), then \( f(2 - h) = \)

(A) \( 4 - 2h + h^2 \) \hspace{1cm} (B) \( 4 - h^2 \) \hspace{1cm} (C) \( 4 - 4h + h^2 \) \hspace{1cm} (D) \( 2 - h^2 \) \hspace{1cm} (E) \( 4 + h^2 \)

19. If the circumference of a certain circle of radius \( r \) is greater than the area of the enclosed circular region, then

(A) \( r > 2 \) \hspace{1cm} (B) \( r < \frac{1}{\sqrt{2}} \) \hspace{1cm} (C) \( r < 1 \) \hspace{1cm} (D) \( r < 2 \) \hspace{1cm} (E) No such circle exists

20. Which of the following numbers is closest to \( \sqrt{\frac{501}{1000}} \)

(A) 2 \hspace{1cm} (B) 50 \hspace{1cm} (C) 3 \hspace{1cm} (D) 0 \hspace{1cm} (E) 1

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End of Part I

The Mathematics 51 Readiness Examination (20 problems) ends here.
The Mathematics 21 Readiness Examination (25 problems) continues with Part II on the next page.
Part II
Assume radian measure in all trigonometric expressions.

21. \( \cos \left( \frac{2\pi}{3} \right) = \) (A) \(-\frac{\sqrt{2}}{2}\) (B) \(\frac{1}{2}\) (C) \(\frac{\sqrt{3}}{2}\) (D) \(-\frac{1}{2}\) (E) \(\frac{\sqrt{3}}{2}\)

22. Of the following, which best represents the graph of \( y = -\sin x \) for \(0 < x < \pi\)?

\[
\begin{array}{c}
(A) \\
(B) \\
(C) \\
(D) \\
(E)
\end{array}
\]

23. Whenever \( \cos \theta \neq 0 \), \( \frac{1 - (\sin \theta)^2}{\cos \theta} = \)

(A) \( \cos \theta \) (B) \(-\cos \theta\) (C) \(\tan \theta - \sec \theta\) (D) \(\sec \theta\) (E) \((\tan \theta)^2 - 1\)

24. For which of the following values of \( x \) is \( \sec x \) not defined?

(A) \(0\) (B) \(\frac{\pi}{4}\) (C) \(\pi\) (D) \(\frac{3\pi}{2}\) (E) \(-\pi\)

25. If \( \sin x \cos x < 0 \) and \(0 < x < 2\pi\), then

(A) \(0 < x < \frac{\pi}{2}\) or \(\frac{\pi}{2} < x < \pi\) (B) \(\frac{\pi}{2} < x < \pi\) or \(\pi < x < \frac{3\pi}{2}\)

(C) \(\pi < x < \frac{3\pi}{2}\) or \(\frac{3\pi}{2} < x < 2\pi\) (D) \(0 < x < \frac{\pi}{2}\) or \(\pi < x < \frac{3\pi}{2}\)

(E) \(\frac{\pi}{2} < x < \pi\) or \(\frac{3\pi}{2} < x < 2\pi\)
Answer Key for Sample Calculus Readiness Assessment

1. C
2. A
3. D
4. C
5. D
6. D
7. E
8. A
9. D
10. D
11. D
12. E
13. E
14. D
15. A
16. A
17. B
18. C
19. D
20. E
21. D
22. E
23. A
24. D
25. E