

# **M110 PreCalculus Diagnostic Test**

Success in a first year Calculus class is highly dependent on your algebra skills. The following is a self-diagnostic test to be taken by students prior to entering a Math 110 Calculus class (note that there is a separate test for students entering Math 103).

Instructions:    Complete the following test in no more than 90 minutes.  
                      Do not use a calculator for any questions.  
                      Do not refer to books, notes, or other material while completing the test.  
                      Only select one answer per question.

Once you have completed all 40 questions, refer to the last page for scoring and recommendations.

1.  $2\left(\frac{1}{4} + \frac{2}{3}\right) =$

a)  $\frac{22}{24}$

b)  $\frac{11}{6}$

c)  $\frac{6}{7}$

d)  $\frac{6}{14}$

e)  $\frac{4}{7}$

2. Express  $\frac{1}{y^2} + \frac{2}{x^2y} + \frac{1}{x^2y^3}$  as a single fraction:

a)  $\frac{x^2y + 2y^2 + 1}{x^2y^3}$

b)  $\frac{4}{x^4y^6}$

c)  $\frac{x + 2y}{x^2y^3}$

d)  $\frac{x^2 + 3y}{x^2y^2}$

e)  $\frac{x^4y^4 + 2xy^5 + x^2}{x^4y^6}$

3. Simplify  $\frac{(2xy^2)^3}{(x^2y)^2}$

a)  $6xy^4$

b)  $8x^7y^8$

c)  $\frac{6y^3}{x}$

d)  $\frac{8y^3}{x}$

e)  $\frac{8y^4}{x}$

4.  $16^{-1/4} \times 4^0 =$

- a)  $-2$
- b)  $\frac{1}{2}$
- c)  $0$
- d)  $-\frac{1}{2}$
- e)  $2$

5. One factor of  $3x^2 + 11x - 4$  is

- a)  $3x+1$
- b)  $x-4$
- c)  $3x-1$
- d)  $x-2$
- e)  $3x+4$

6. Factor  $x^2 + 2x - 8$

- a)  $(x+2)(x-4)$
- b)  $(x+8)(x-1)$
- c)  $(x-8)(x+1)$
- d)  $(x-2)(x+4)$
- e)  $(x-4)(x-2)$

7. If  $x^2 - 4x + 1 = 0$ , then  $x =$

- a)  $2 + \sqrt{3}, 2 - \sqrt{3}$
- b)  $-2 + \sqrt{3}, -2 - \sqrt{3}$
- c)  $2 + \sqrt{5}, 2 - \sqrt{5}$
- d)  $\sqrt{3}, -\sqrt{3}$
- e) None of the above.

8. If  $|2x - 3| = 9$ , then  $x =$

- a)  $-6$  or  $3$
- b)  $-6$  or  $-3$
- c)  $6$  or  $-3$
- d)  $6$  or  $3$
- e) None of the above.

9. If  $|x-3| > 5$ , then

- a)  $-2 < x < 8$
- b)  $-8 < x < 2$
- c)  $x < -8 \cup x > 2$
- d)  $x < -2 \cup x > 8$
- e)  $x < -8 \cup x > -2$

10. If  $x^2 - 2x - 3 \leq 0$ , then

- a)  $x \leq -1 \cup x \geq 3$
- b)  $x \leq -3 \cup x \geq 1$
- c)  $-3 \leq x \leq 1$
- d)  $1 \leq x \leq 3$
- e)  $-1 \leq x \leq 3$

11. Solve the following pair of equations for  $x$  and  $y$ :  $2x - y = 5$  and  $4x + y = 7$

- a)  $x = -2, y = 1$
- b)  $x = 2, y = -1$
- c)  $x = 1, y = -3$
- d)  $x = -6, y = -17$
- e)  $x = 2, y = 1$

12. 
$$\frac{\frac{1}{xy} - 1}{\frac{1}{x^2} - \frac{y}{x}} =$$

- a)  $\frac{y}{x}$
- b)  $\frac{x}{y}$
- c)  $\frac{1-xy}{x}$
- d)  $xy$
- e)  $xy - 1$

13.  $\frac{1}{2x+18} - \frac{x}{x^2-81} =$

a)  $\frac{-1}{2(x-9)}$

b)  $\frac{-3(x+3)}{2(x+9)(x-9)}$

c)  $\frac{-1}{2(x+9)}$

d)  $\frac{-9}{(x+9)(x-9)}$

e)  $\frac{1-x}{(x-9)(x+7)}$

14. If  $x = 11$  and  $y = 25$ , then  $(x + y)^{-1/2} =$

a) 6

b) -6

c)  $\frac{\sqrt{11}}{55}$

d)  $\frac{1}{6}$

e)  $-\frac{1}{6}$

15. Factor  $16x^4 - 1$

a)  $(2x-1)^2(2x+1)^2$

b)  $(4x-1)^2(4x+1)^2$

c)  $(2x-1)(2x+1)(4x^2+1)$

d)  $(2x-1)(2x+1)(2x^2-1)$

e)  $(2x-1)(2x+1)(2x^2+1)$

16. If  $\frac{5}{x+2} = \frac{5-x}{x-2} + 1$ , then  $x =$

- a) 2
- b) -8
- c) 8
- d) -2
- e) None of the above.

17. If  $f(x) = x^2 - 1$  then  $f(x - 1) =$

- a)  $x^2 - 2$
- b)  $x^2 - 2x - 2$
- c)  $x^2 - x$
- d)  $x^2 - 2x$
- e)  $x^2$

18. Let  $x > 0$  and  $f(x) = \sqrt{4x + 8}$  and  $g(x) = x^2 - 2$ . Evaluate  $g(f(x)) - f(g(x)) =$

- a)  $x$
- b) 0
- c)  $6x + 6$
- d)  $4x - 2$
- e)  $2x + 6$

19. The graph of the equation  $y = 4 - x$  is

- a) a parabola with vertex  $(x, y) = (1, 4)$
- b) a parabola with vertex  $(x, y) = (-1, 4)$
- c) a line with slope  $-1$  and intercept 4
- d) a line with slope 4 and intercept  $-1$
- e) a circle with radius 2

20. The graph of the equation  $y^2 = 4 - x^2$  is

- a) a parabola with vertex  $(x, y) = (1, 4)$
- b) a parabola with vertex  $(x, y) = (-1, 4)$
- c) a line with slope  $-1$  and intercept 4
- d) a line with slope 4 and intercept  $-1$
- e) a circle with radius 2

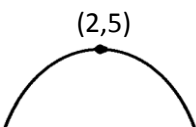

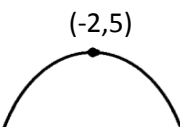

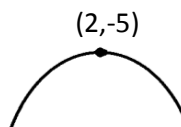
21. Find the equation of the straight line through points  $(x, y) = (-2, 1)$  and  $(x, y) = (1, -2)$ .

- a)  $y = x - 1$
- b)  $y = x + 1$
- c)  $y = -2x + 1$
- d)  $y = 1 - x$
- e)  $y = -x - 1$

22. Find the equation of the line perpendicular to  $x + 3y = 4$  through the point  $(x, y) = (1, 5)$ .

- a)  $3x - y = -2$
- b)  $x + 3y = 16$
- c)  $3x + y = 8$
- d)  $x - 3y = -14$
- e)  $3x + y = 4$

23. Which graph best represents the equation  $y = -x^2 - 4x + 1$ ?

- a)  b)  c)  d)  e) 

24. The line  $y = \frac{1}{2}x + 1$  intersects the parabola  $y = x^2 - 4x + 3$  at

- a)  $x = 4$  and  $x = \frac{1}{2}$
- b)  $x = 1$  and  $x = \frac{1}{4}$
- c)  $x = -\frac{1}{2}$  and  $x = 4$
- d)  $x = \frac{1}{2}$  and  $x = \frac{1}{4}$
- e) None of the above.

25. The parabolas  $y = x^2 + 2x + 2$  and  $y = -2x^2 + 8x - 7$  intersect at points  $(x, y) =$

- a)  $(1, 1)$  and  $(3, -2)$
- b)  $(1, 1)$  and  $(3, 17)$
- c)  $(-1, 1)$  and  $(3, -2)$
- d)  $(-1, -1)$  and  $(3, 17)$
- e) none of the above

26. After a 20% price decrease, the cost of an item is \$4.20. What was the original price?

- a) \$4.40
- b) \$5.04
- c) \$5.00
- d) \$4.96
- e) \$5.25

27. Adam can shovel a driveway in two hours. Bev can shovel the same driveway in three hours. How long would it take them working together?

- a) 2 hours 30 minutes
- b) 2 hours 20 minutes
- c) 48 minutes
- d) 1 hour 12 minutes
- e) 1 hour 36 minutes

28. A car leaves Regina at 1 PM and drives along Highway #1 at constant speed 85 km/h. A 2<sup>nd</sup> car leaves Regina at 1:30 PM and follows the same highway at constant speed 110 km/h. At what time will it pass the first car?

- a) 1:47 PM
- b) 2:07 PM
- c) 2:42 PM
- d) 3:12 PM
- e) 3:30 PM

29. A cell phone plan costs \$20 a month and includes 200 free minutes. Each additional minute costs 5 cents. Assume you use your cell phone for *at least* 200 minutes a month. If  $x$  is the total number of minutes a month, then your total cost  $C$  is given by

- a)  $C = 10 + .05x$
- b)  $C = 20x + .05$
- c)  $C = 20 + .05x$
- d)  $C = 20.05x$
- e)  $C = 30 + .05x$

30. Find the area of the triangle that has sides with length 3, 4, and 5.

- a) 6
- b) 7.5
- c) 10
- d) 12
- e) 15

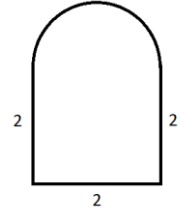
31. Find the distance between points  $(x, y) = (-1, 2)$  and  $(x, y) = (3, 4)$ .

- a) 5
- b)  $\sqrt{8}$
- c)  $\sqrt{10}$
- d)  $\sqrt{20}$
- e)  $\sqrt{40}$



32. Find the total area of the given shape, a square with side length 2 topped by a semi-circle.

- a)  $6 + \pi$
- b)  $2 + \pi$
- c)  $4 + 4\pi$
- d)  $4 + \frac{\pi}{2}$
- e)  $4 + \pi$



33. How many degrees is  $\frac{\pi}{6}$  radians?

- a) 180
- b) 90
- c) 60
- d) 45
- e) 30

34.  $\sin(60^\circ) =$

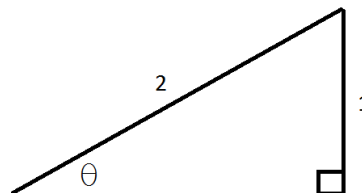
- a) 0
- b)  $\frac{1}{2}$
- c)  $\frac{\sqrt{2}}{2}$
- d)  $\frac{\sqrt{3}}{2}$
- e) 1

35.  $\cos\left(\frac{5\pi}{4}\right) =$

- a)  $\frac{\sqrt{3}}{2}$
- b)  $-\frac{\sqrt{3}}{2}$
- c)  $\frac{\sqrt{2}}{2}$
- d)  $-\frac{\sqrt{2}}{2}$
- e) None of the above.

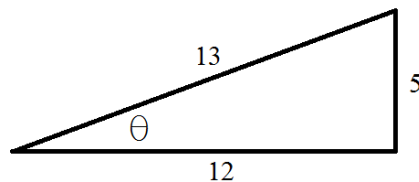
36. The angle  $\theta$  (in radians) in the given diagram is

- a)  $\frac{\pi}{8}$
- b)  $\frac{\pi}{6}$
- c)  $\frac{\pi}{4}$
- d)  $\frac{\pi}{3}$
- e)  $\frac{\pi}{2}$



37. In the given diagram,  $\tan\theta =$

- a)  $5/12$
- b)  $5/13$
- c)  $12/13$
- d)  $12/5$
- e)  $13/5$



38. Which of the following values is largest?

- a)  $\sin(30^\circ)$
- b)  $\sin(60^\circ)$
- c)  $\sin(70^\circ)$
- d)  $\sin(85^\circ)$
- e)  $\sin(100^\circ)$

39. At what points in the interval  $x \in [0, 2\pi]$  does  $y = \sin(x)$  intersect  $y = \cos(x)$ ?

- a)  $x = \frac{\pi}{4}$  and  $x = \frac{3\pi}{4}$
- b)  $x = \frac{\pi}{4}$  and  $x = \frac{5\pi}{4}$
- c)  $x = \frac{3\pi}{4}$  and  $x = \frac{5\pi}{4}$
- d)  $x = \frac{\pi}{4}$  and  $x = \frac{7\pi}{4}$
- e)  $x = \frac{3\pi}{4}$  and  $x = \frac{7\pi}{4}$

40.  $\sin^2\left(\frac{\pi}{7}\right) + \cos^2\left(\frac{\pi}{7}\right) =$

- a) 0
- b)  $\frac{\pi^2}{49}$
- c) 1
- d)  $\frac{\pi}{7}$
- e) None of the above.

## **Answers and Scoring**

The answer key is given as follows.

1b    2a    3e    4b    5c    6d    7a    8c    9d    10e

11b   12b   13a   14d   15c   16c   17d   18e   19c   20e

21e   22a   23c   24a   25e   26e   27d   28d   29a   30a

31d   32d   33e   34d   35d   36b   37a   38d   39b   40c

Add up your correct answers for all 40 questions.      Your score: \_\_\_\_\_ out of 40

### **Recommendations:**

If you scored 31 or more points, you are likely ready for Calculus. However, you will want to review any areas of weakness that arose while you were working on this test. Refer to the resources section for some review suggestions.

If you scored between 20 and 30 points, and are planning to enroll in Calculus, you should definitely review relevant PreCalculus material as soon as possible. Refer to the resources section for some review suggestions. If you do not feel comfortable doing this on your own, you may wish to consider enrolling in PreCalculus Math 102 instead.

If you scored less than 20 points, you will likely have a difficult time with the material in a Calculus course and face a high probability of failure. You should consider enrolling in PreCalculus Math 102 instead.

***Note: While your score on this test is a good indication of how well you might do in a Calculus class, it is of course not a guarantee of either your success or failure.***

## Resources

### 1. Google Terms

The following is a list of relevant terms for each of the 40 questions in this diagnostic test. If you had difficulties with specific questions, you may wish to google the given term below to look for useful resources, including online examples, YouTube videos, and more.

1. Google: "fraction arithmetic"
2. Google: "simplify algebraic expressions involving fractions"
3. Google: "simplify algebraic expressions involving exponents"
4. Google: "exponent arithmetic"
5. Google: "factoring trinomials"
6. Google: "factoring trinomials"
7. Google: "quadratic formula"
8. Google: "solving equations involving absolute values"
9. Google: "solving inequalities involving absolute values"
10. Google: "solving quadratic inequalities"
11. Google: "solving two linear equations"
12. Google: "simplify algebraic expressions involving complex fractions"
13. Google: "simplify algebraic expressions involving common denominators"
14. Google: "exponent arithmetic"
15. Google: "difference of squares"
16. Google: "solving rational equations"
17. Google: "evaluating functions"
18. Google: "function composition examples"
19. Google: "equation of a line"
20. Google: "equation of a parabola"
21. Google: "equation of a line through two points"
22. Google: "equation of a perpendicular line"
23. Google: "finding the vertex of a parabola"
24. Google: "intersection of line and parabola example"
25. Google: "intersection of two parabolas"
26. Google: "working with percentages"
27. Google: "shared work word problems"
28. Google: "distance speed time problems"
29. Google: "linear cost function examples"
30. Google: "area of triangles"
31. Google: "distance between two points"
32. Google: "area of squares and circles"

33. Google: "convert radians to degrees"
34. Google: "trigonometry of right triangles"
35. Google: "trigonometry with angles larger than pi"
36. Google: "trigonometry of right triangles"
37. Google: "trigonometry of right triangles tangent"
38. Google: "trigonometric functions"
39. Google: "intersect of sine and cosine"
40. Google: "trigonometric identities"

## **2. Text Resources**

If you require more in-depth review (and have elected not to enrol in Math 102), you should also consider working through a PreCalculus text.

The following are online open text (i.e. free) resources:

- Precalculus, 3rd Edition: <http://www.stitz-zeager.com/>
- Precalculus: An Investigation of Functions: <http://www.opentextbookstore.com/precalc/>

The following are relatively inexpensive PreCalculus books that can be ordered through online booksellers (such as Amazon).

- Just-in-Time Algebra and Trigonometry for Calculus, by Mueller, Brent
- Schaum's Outline of PreCalculus, by Safier