

# **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 Calculus class (Math 103 or Math 110).

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.

Note: Questions #33-40 are split into Section A and Section B.  
If you plan to enrol in Math 103, complete the questions from Section A only.  
If you plan to enrol in Math 110, complete the questions from Section B only.

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

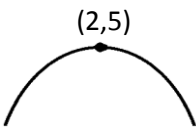
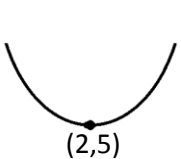
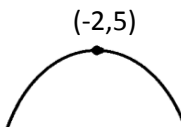
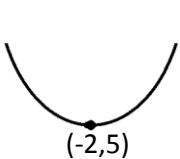
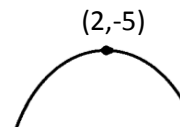
21. Find the equation of the straight line through points  $(x, y) = (-2, 1)$  and  $(x, y) = (1, -2)$ .

- 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

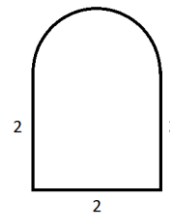
31. Find the distance between points  $(x, y) = (-1, 2)$  and  $(x, y) = (3, 4)$ .

- 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)  $4 + \pi$



**IMPORTANT:** If you plan to go on to Math 103, complete questions 33-40 in Section A. If you plan to go on to Math 110, skip Section A and complete questions 33-40 in Section B.

**SECTION A** – Complete these if you plan to go on to Math 103.

33. If  $\log_a 64 = 2$ , then  $a =$

- a)  $-8$
- b)  $32$
- c)  $128$
- d)  $4096$
- e)  $8$

34.  $\log_{\frac{1}{3}} 27 =$

- a)  $3$
- b)  $9$
- c)  $-9$
- d)  $-3$
- e) none of the above

35. If  $\log x = 2$  and  $\log y = 4$ , then  $\log(xy^2) =$

- a)  $16$
- b)  $12$
- c)  $32$
- d)  $10$
- e)  $8$

36. If  $4^{x+1} = 8$ , then  $x =$

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

37. Simplify  $e^{4x-2}e^{x+1}$

- a)  $e^{5x-1}$
- b)  $e^{4x^2+2x-2}$
- c)  $e^{3x-3}$
- d)  $e^{3x-1}$
- e)  $e^3$

38. If  $4^x = 40$ , then

- a)  $x = 10$
- b)  $\log_x 4 = 40$
- c)  $\log_{40} x = 4$
- d)  $\log_4 40 = x$
- e)  $\log_{40} 4 = x$

39. If  $\log_2 x + \log_2 (x-2) = 3$ , then  $x =$

- a) 4, -2
- b) 4
- c) -2
- d) 2, -4
- e) None of the above

40.  $\log_5 \sqrt{5} =$

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

**SECTION B** – Complete these if you plan to go on to Math 110.

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

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

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

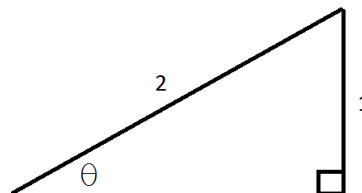
- a) 0
- b)  $\frac{1}{2}$
- c)  $\frac{\sqrt{2}}{2}$
- d)  $\frac{\sqrt{3}}{2}$
- e) 1

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.

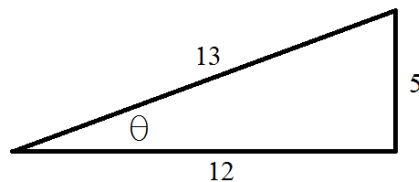
36. The angle  $\theta$  (in radians) in the given diagram is

- 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.

Name:

Student ID:

Please circle which section you completed for  
Questions 32-40:

Section A Math 103 or Section B Math 110

**YOUR ANSWERS: (indicate A-E in each case)**

- |     |     |     |
|-----|-----|-----|
| 1.  | 16. | 31. |
| 2.  | 17. | 32. |
| 3.  | 18. | 33. |
| 4.  | 19. | 34. |
| 5.  | 20. | 35. |
| 6.  | 21. | 36. |
| 7.  | 22. | 37. |
| 8.  | 23. | 38. |
| 9.  | 24. | 39. |
| 10. | 25. | 40. |
| 11. | 26. |     |
| 12. | 27. |     |
| 13. | 28. |     |
| 14. | 29. |     |
| 15. | 30. |     |