MATH 151 - Are You Ready for Calculus?

The following questions are designed to give you an idea of what you should know when you start MATH 151. The questions relate to topics taught in Pre-Calculus. If you do not think you could answer 75% or more of these correctly, you might want to enroll in Pre-calculus (or lower) before attempting MATH 151.

1. If \( f(x) = 4 - 3x \) and \( g(x) = x + 3 \), then \( f(g(x)) \) is:
   (a) \(-5 - 3x\)  
   (b) \(13 - 3x\)  
   (c) \(5 - 3x\)  
   (d) \(7 - 3x\)

2. The domain of \( f(x) = 2\sqrt{2-x} \) is:
   (a) \(x \leq -2\)  
   (b) \(x \leq 2\)  
   (c) \(x \geq -2\)  
   (d) \(x \geq 2\)

3. If \( f(x) = \frac{1}{2}x + 3 \), then the inverse function of \( f(x) \) is:
   (a) \(f^{-1}(x) = x + 6\)  
   (b) \(f^{-1}(x) = 2x - 6\)  
   (c) \(f^{-1}(x) = -x + 6\)  
   (d) \(f^{-1}(x) = -2x - 6\)

4. The following table approximates world population in millions in 20 year intervals beginning with 1900. The average rate of change of population in millions between the years 1940 and 1960 is:

<table>
<thead>
<tr>
<th>YEAR</th>
<th>1900</th>
<th>1920</th>
<th>1940</th>
<th>1960</th>
<th>1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>POPULATION</td>
<td>1571</td>
<td>1786</td>
<td>2231</td>
<td>3027</td>
<td>4478</td>
</tr>
</tbody>
</table>
   (a) \(2915\)  
   (b) \(796\)  
   (c) \(145.4\)  
   (d) \(39.8\)

5. Which function could describe the graph shown to the right?
   (a) \(f(x) = 3(2)^x\)  
   (b) \(f(x) = 6x^2\)  
   (c) \(f(x) = 6^x\)  
   (d) \(f(x) = 2(3)^x\)

6. The difference quotient, \(\frac{f(x+h) - f(x)}{h}\), for the function \(f(x) = x^2 - 3x\) is given by:
   (a) \(2xh - h^2 - 3\)  
   (b) \(2x - 3\)  
   (c) \(2x + h - 3\)  
   (d) \(1\)
7. If \( f(x) = \ln(x) \) and \( g(x) = \sin(x) \), then \( f(g(\pi/2)) \) equals:

(a) 0 (b) -1 (c) 1 (d) undefined

8. Which of the following is a false statement?

(a) \( \sin(-x) = -\sin(x) \)  
(b) \( \cos(-x) = -\cos(x) \)
(c) \( \tan(-x) = -\tan(x) \)  
(d) \( \sin(\pi) = \sin(0) \)

Questions 9 and 10 refer to the following situation. A model rocket is launched straight up from a platform at time \( t = 0 \) (where \( t \) is measured in seconds). The altitude \( h(t) \) of the rocket above the ground at time \( t \) is given by \( h(t) = -16t^2 + 128t + 10 \) (where \( h(t) \) is measured in feet).

9. The altitude of the rocket when it is launched is:

(a) 0 feet (b) 10 feet (c) -16 feet (d) 16 feet

10. The time it takes the rocket to reach its maximum altitude is:

(a) 0 seconds (b) 4 seconds (c) 8 seconds (d) 16 seconds

11. Which of the graphs below could not be a cubic polynomial.
12. The complete graph of a 4th degree polynomial function with leading coefficient 1 is shown at right. Which of the following could be the formula for the function?

(a) \( y = (x + 3)(x - b)^2(x - c) \)
(b) \( y = (x + 3)(x - b)(x - c) \)
(c) \( y = x(x + 3)(x - b)(x - c) \)
(d) \( y = (x - 3)(x + b)^2(x + c) \)

13. A rectangular garden with an area of 225 square meters is to be located next to a barn, with fencing on three sides and the barn acting as a fence on the fourth side. The length of the side parallel to the barn will be labeled \( x \) (see sketch). The function that gives the total amount of fencing \( T \) needed is given by:

(a) \( T = \frac{225}{x} + x \)
(b) \( T = \frac{450}{x} + x \)
(c) \( T = 450 + 2x \)
(d) \( T = \frac{450}{x} + 2x \)

14. Simplify completely: \( e^{-3\ln(x)} \)

(a) \(-3x\)  
(b) \(-x^3\)  
(c) \(-3\ln(x)\)  
(d) \(\frac{1}{x^3}\)

15. Solve for \( x \): \( \ln(2x + 1) = y \)

(a) \( x = \frac{\ln(y) - 1}{2} \)  
(b) \( x = \frac{e^y + 1}{2} \)  
(c) \( x = \frac{e^y - 1}{2} \)  
(d) \( x = \ln\left(\frac{y - 1}{2}\right) \)

16. Which of the following can be true about a real number \( t \)?

(a) \( \sin(t) = \frac{5}{13} \) and \( \cos(t) = \frac{8}{13} \)  
(b) \( \sin(t) = -1 \) and \( \cos(t) = 1 \)

(b) \( \sin(t) = \frac{\sqrt{2}}{2} \) and \( \cos(t) = -\frac{1}{2} \)  
(d) \( \sin(t) = \frac{5}{13} \) and \( \cos(t) = -\frac{12}{13} \)
17. A boat runs in a straight line for 4 km and then makes a 90° turn and goes for another 6 km. How many kilometers is the boat from its starting point?

(a) 4.4  (b) 7.2  (c) 7.8  (d) 8.4

18. A road rises 200 feet per horizontal mile. What is the angle of elevation of the road? Recall a mile is 5,280 feet.

(a) 0.0227°  (b) 1.3022°  (c) 2.1647°  (d) 3.2417°

19. An angle measuring \(\pi/9\) radians cuts off an arc on a circle. The circle has a radius of 4. The approximate length of the arc is:

(a) 0.8  (b) 1.4  (c) 2.5  (d) 3.7

20. How many solutions does \(\sin(x) = \frac{5}{7}\) have in the interval \((-\pi, \pi)\)?

(a) 1  (b) 2  (c) 3  (d) 4

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Questions 21 and 22 refer to the right triangle shown to the right. (The triangle is not drawn to scale)

21. To the nearest integer, the length of side \(a\) is:

(a) 3  (b) 7  (c) 9  (d) 19

22. To the nearest degree, the angle A is:

(a) 37°  (b) 39°  (c) 51°  (d) 53°
For questions 23 to 25: Match each of the function types with an appropriate graph selected from the set below. The letters $c$ and $k$ in the formulas are constants. Be sure to consider all alternatives before selecting.

23. $y = ce^{kx}$ with $k < 0$  

24. $y = k\sqrt{x}$ with $k < 0$  

25. $y = k\ln(x)$  

(a) (b) (c) (d) (e)