1. True or False?

$$\lim_{x\to\infty} \frac{3x^3 + 4x^2}{4x^3 - 7}$$ does not exist.

2. Which of the following is closest to $\sqrt{99}$?

(A) 10.00

(B) 9.99

(C) 9.97

(D) 9.95

Note. It's probably in your best interest to try to figure this out without using a calculator.

3.   Which of the following is closest to $e^{1.1}$?

(A) 2.7183

(B) 2.8522

(C) 2.9029

(D) 2.9898

Note. $e \approx 2.7183$. Again, it's probably in your best interest to try to figure this out without a calculator.

4. True or False?

$$\int_0^{\pi/2} (\cos x)^{2018} \sin x \, dx = \frac{1}{2019}.$$

5. True or False?

$$\frac{d}{dx}\arcsin(x) = \frac{1}{\sqrt{1-x^2}}.$$

Hint. If $y = \arcsin(x)$, then $\sin(y) = x$. Differentiate this equation implicitly.

6. A plane passes directly above a radar station at an altitude of 6 km, going at a speed of 15 km/min. How fast is the distance between the plane and the station changing at the instant when the plane passes directly above the radar station?

(A) 0.1 km/min

(B) 0.3 km/min

(C) 0.9 km/min

(D) None of the above

6.   A plane passes directly above a radar station at an altitude of 6 km, going at a speed of 15 km/min. How fast is the distance between the plane and the station changing at the instant when the plane passes directly above the radar station?

(A) 0.1 km/min

(B) 0.3 km/min

(C) 0.9 km/min

(D) None of the above

Hint. It's possible to think through a solution to this problem without doing any calculations.

7.   True or False?

$\lim\limits_{x \to 0} \dfrac{\tan x}{x}$ does not exist.

8. True or False?

The tangent line to the curve defined by

$$2xy^2 + x + y = 0$$

at the point $(0, 0)$ is horizontal.

9. Let f be the function defined by

$$f(x) = |x^2 - 2|.$$

For how many values c does $f'(c)$ not exist?

(A) None

(B) 1

(C) 2

(D) 3 or more

10.   How many values of c are there such that the following function is continuous?

$$f(x) = \begin{cases} \cos(x) & \text{if } x < 0 \\ c & \text{if } x = 0 \\ cx^3 + 1 & \text{if } x > 0 \end{cases}$$

(A) None

(B) 1

(C) 2

(D) 3 or more

11.   True or False?

$$\lim_{x\to 0} \frac{x^2}{1 - \cos x} = 2.$$

12.   True or False?

$$\int_1^{e^2} \frac{\ln x}{x}\, dx = 0.$$

13.   True or False?

A 10 kg quantity of a certain substance decays to 1 kg in 5000 years. Then the half-life of this substance is

$$\frac{5000}{\log_2(10)}.$$

Note. $\dfrac{5000}{\log_2(10)} \approx 1505.15$.

14.   True or False?

The equation $e^x + x^4 = 0$ has a solution.

15.   True or False?

The equation $e^x - x^4 = 0$ has a solution.