

1. True or False?

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

2. True or False?

$$5 < \sqrt{26} < 5.1.$$

3. True or False?

The equation  $e^x = \frac{1}{x}$  has exactly one solution.

4. 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.**  $\frac{5000}{\log_2(10)} \approx 1505.15.$

5. True or False?

$$\int_0^{\pi/2} (\cos x)^{2019} \sin x \, dx = \frac{1}{2020}.$$

6. True or False?

$\lim_{x \rightarrow 0} \frac{\tan x}{x}$  does not exist.

7. True or False?

If  $f$  is a differentiable function whose graph passes through  $(1, 4)$  and  $(2, 6)$ , then there must exist some  $b$  between 1 and 2 such that  $f'(b) = 2$ .

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?

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

12. True or False?

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

13. 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

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

(A) 2.7180

(B) 2.8522

(C) 2.9029

(D) 2.9898

**Note.**  $e \approx 2.718$ . It's probably in your best interest to try to figure this out without a calculator.