

1. Suppose in x years, Billy Bob will be twice as old as he was 5 years ago. How old is Billy Bob now in terms of x ?

- (a) $x + 2$
- (b) $x + 4$
- (c) $x + 5$
- (d) $x + 8$
- (e) $x + 10$

2. Let R be the region bounded by $h(t) = te^{t^2}$, $t = 0$, $t = 1$, and $h = 0$. Find the area of R .

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

3. Suppose the following statement is false:

They like roses, but they don't like sunflowers.

Which of the following is a true statement?

- (a) If they don't like roses, then they like sunflowers.
- (b) If they like roses, then they like sunflowers.
- (c) If they don't like roses, then they don't like sunflowers.
- (d) If they like roses, then they don't like sunflowers.
- (e) They don't like roses, but they like sunflowers.

4. Suppose two 6-sided dice are thrown, each of which gives a whole number value from 1-6. What is the probability that both dice give a 6 value?

- (a) $\frac{1}{3}$
- (b) $\frac{1}{6}$
- (c) $\frac{1}{12}$
- (d) $\frac{1}{18}$
- (e) $\frac{1}{36}$

5. Suppose that

$$x = \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{\dots}}}}}}}$$

Simplify x .

- (a) $x = \sqrt{2}$
- (b) $x = \sqrt{3}$
- (c) $x = 2$
- (d) $x = \sqrt{8}$
- (e) $x = 4$

6. Evaluate $\cos\left(\frac{\pi}{8}\right)$.

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

7. Suppose in a recent poll, 24% of students like math, 36% like stats, and 13% like both math and stats. What percent of students like neither math nor stats?
- (a) 76%
 - (b) 87%
 - (c) 40%
 - (d) 53%
 - (e) 64%

8. Suppose that the population $P(t)$ of a certain species at time t (measured in years) satisfies the exponential growth model

$$P(t) = P_0 e^{kt},$$

where P_0 is a real number and k is the growth rate. If the population is 2 initially and grows to 100 after 1 year, find the population after 2 years.

- (a) 198
 - (b) 202
 - (c) 1000
 - (d) 5000
 - (e) 10000
9. Evaluate $\cos(1879\pi)$.
- (a) -1
 - (b) 0
 - (c) 1
 - (d) $\frac{\sqrt{2}}{2}$
 - (e) $\frac{\sqrt{3}}{2}$

10. Calculate the following sum:

$$1 + 2 + 3 + 4 + \dots + 997 + 998 + 999 + 1000$$

- (a) 400500
- (b) 450500
- (c) 500500
- (d) 550500
- (e) 600500

11. Evaluate $\tan\left(\cos^{-1}\left(\frac{7}{12}\right)\right)$.

(a) $\frac{7}{12}$

(b) $\frac{12}{7}$

(c) $\frac{49}{144}$

(d) $\frac{\sqrt{95}}{7}$

(e) $\frac{\sqrt{95}}{12}$

12. Find the equation of the line that is tangent to $f(x) = \ln(x)$ at $x = e$.

(a) $y = \frac{x}{e}$

(b) $y = \frac{x}{e} - 2$

(c) $y = ex + 2$

(d) $y = ex$

(e) $y = e(x - 1)$

13. Suppose both the following statements are true:

I. If it rains, it will pour.

II. If it pours, it will flood.

Suppose that there is not a flood. What can be concluded?

(a) It did not pour, but it rained.

(b) It did not rain, but it poured.

(c) It did not pour nor did it rain.

(d) It rained.

(e) It rained and poured.

14. Suppose IQ scores follow a normal distribution with mean 100 and standard deviation 15. About what percent of people have an IQ score between 85 and 115?
- (a) 33%
 - (b) 38%
 - (c) 50%
 - (d) 68%
 - (e) 75%

15. Calculate the sample standard deviation for the following data set:

4, 8, 12, 16

- (a) $2\sqrt{5}$
 - (b) $\frac{\sqrt{5}}{\sqrt{3}}$
 - (c) $\frac{2\sqrt{5}}{\sqrt{3}}$
 - (d) $\frac{4\sqrt{5}}{\sqrt{3}}$
 - (e) $\frac{8\sqrt{5}}{\sqrt{3}}$
16. Simplify the expression $[\csc(x) - \sin(x)] \sec(x)$.
- (a) $\cos(x)$
 - (b) $1 - \tan(x)$
 - (c) $\tan(x) - 1$
 - (d) $\tan(x)$
 - (e) $\cot(x)$

17. Evaluate $\lim_{x \rightarrow \infty} (\sqrt{x^2 + x} - \sqrt{x^2 - x})$, if the limit exists.
- (a) 0
 - (b) 1
 - (c) -1
 - (d) 2
 - (e) The limit does not exist.

18. Find θ (in radians) so that $\cot(\theta) = -1$ and $\cos(\theta) < 0$.

- (a) $\frac{\pi}{4}$
- (b) $\frac{\pi}{3}$
- (c) $\frac{2\pi}{3}$
- (d) $\frac{3\pi}{4}$
- (e) $\frac{5\pi}{6}$

19. Suppose there are 3 coins on the table: gold, silver, and bronze. If you make a truthful statement, you will get one coin. If you make a false statement, you will get nothing. What sentence can guarantee you getting the gold coin regardless of the statement's truth?

- (a) I will take either the bronze coin or the silver coin.
- (b) I will take neither the bronze coin nor the silver coin.
- (c) I will not take the gold coin.
- (d) I will not take the silver coin.
- (e) No statement can guarantee getting the gold coin.

20. Suppose you are standing on a flat surface and see a golf ball on the ground with angle of depression of 30 degrees. Given that your eyes are 5 feet above the ground, how far is the ball from your eyes (in feet)?

- (a) 5
- (b) 10
- (c) 300
- (d) $5\sqrt{3}$
- (e) $\frac{5}{\sqrt{3}}$

21. Suppose a property is defined as follows:

For every x , there exists y with $x > y$.

What does it mean for this property NOT to hold?

- (a) For all x and all y , we have $x \leq y$.
- (b) For some x and all y , we have $x \leq y$.
- (c) For some x and some y , we have $x \leq y$.
- (d) For all x , there is no y with $x \leq y$.
- (e) For some x , there is no y with $x \leq y$.

22. Define $\exp(x) = e^x$ and suppose $g(t) = \begin{cases} \exp\left(-\frac{\pi}{t}\right), & \text{if } t > 0 \\ 0, & \text{if } t \leq 0. \end{cases}$

Evaluate $g'(0)$, if it exists.

- (a) π
- (b) $e^{-\pi}$
- (c) 1
- (d) 0
- (e) $g'(0)$ does not exist.

23. Calculate the median for the following data set:

1, 18, 12, 116, 30, 31

- (a) 18
- (b) 24
- (c) 30
- (d) $\frac{104}{3}$
- (e) 64

24. How many solutions (in radians) exist for $1 - \sin^2(x) = \frac{3}{2} - \cos^2(x)$ in $\frac{\pi}{4} \leq x \leq \frac{3\pi}{4}$?

- (a) 0
- (b) 1
- (c) 2
- (d) 3
- (e) 4

25. Expand the expression $\csc(2x)$.

(a) $\frac{1}{2 \csc(x) \sec(x)}$

(b) $\frac{2}{\csc(x) \sec(x)}$

(c) $2 \csc(x) \sec(x)$

(d) $\frac{1}{2} \csc(x) \sec(x)$

(e) none of the above

26. Suppose a building casts a shadow 40 feet long and in the same place at the same time, a 1-foot ruler casts a shadow 8 inches long in the same direction. How tall is the building (in feet)?

(a) 320

(b) 60

(c) 5

(d) $\frac{80}{3}$

(e) $\frac{1}{5}$

27. Find x in the following pattern:

1, 2, 4, 7, 12, 20, 33, x

(a) 47

(b) 51

(c) 54

(d) 57

(e) 60

28. There are five books A, B, C, D and E placed on a table. If A is placed below E, C is placed above D, B is placed below A, and D is placed above E, then which of the following books touches the surface of the table ?

- (a) A
- (b) B
- (c) C
- (d) D
- (e) E

29. Evaluate $\sin^{-1}(\sin(\pi))$.

- (a) 0
- (b) $\frac{\pi}{2}$
- (c) π
- (d) $\frac{3\pi}{2}$
- (e) 2π

30. Suppose $h(t) = \begin{cases} 2, & \text{if } 0 \leq t \leq 1 \\ 3, & \text{if } 1 < t \leq 2 \end{cases}$ and define $F(x) = \int_0^x h(t)dt$ for $0 \leq x \leq 2$.

Evaluate $F'(1)$, if it exists.

- (a) 0
- (b) 1
- (c) 2
- (d) 3
- (e) $F'(1)$ does not exist.