

Trigonometric Wonders of the Natural World

Trigonometry · Answer Key · 15 Questions

1. The 'swing' of a pendulous branch or animal limb can be modeled by sine functions. In a simple harmonic motion model, what does the 'amplitude' represent in the context of a bird's wing flap?

- A) The frequency of the flap
- B) The maximum displacement from the equilibrium position**
- C) The time taken for one full cycle
- D) The speed of the wing tip

2. In a right-angled triangle formed by the shadow cast by a tree and the tree's height, the ratio of the opposite side to the adjacent side is known as which trigonometric function?

- A) Sine
- B) Cosine
- C) Tangent**
- D) Secant

3. When calculating the angle of inclination of a cliff face where a bird of prey is nesting, the hypotenuse of the triangle represents what?

- A) The horizontal distance from the base
- B) The vertical height of the cliff
- C) The direct line-of-sight distance from the observer to the nest**
- D) The angle of the sun

4. The periodic rise and fall of tides in an estuary can be modeled using a cosine function. What does the 'period' of this function represent?

- A) The maximum tide height
- B) The difference between high and low tide
- C) The time interval between two consecutive high tides**
- D) The starting height of the tide

5. When tracking the migration path of a whale using triangulation, if you have two observation points and the distance between them, which law is most useful to find the distance to the whale?

- A) Law of Sines**
- B) Pythagorean Theorem
- C) Quadratic Formula
- D) Linear regression

6. The phyllotaxis angle, often observed in sunflower seed arrangements to maximize sunlight exposure, is approximately 137.5 degrees. This is derived from which irrational number related to trigonometry and growth patterns?

A) Pi

B) The Golden Ratio

C) Euler's number

D) Square root of 2

7. In the study of fluid dynamics for swimming fish, the 'Strouhal number' involves the frequency of tail oscillation and the amplitude. If a tail moves in a wave-like pattern, the displacement can be expressed using which function?

A) Logarithmic

B) Sine

C) Exponential

D) Inverse

8. To determine the height of a canopy tree using a clinometer, you measure the angle of elevation. If the angle is 45 degrees, what can you conclude about the triangle formed by the observer and the tree?

A) The height is equal to the distance from the tree

B) The height is double the distance

C) The height is half the distance

D) The angle is too small for calculation

9. The sound waves produced by a cricket (stridulation) can be modeled as periodic functions. The 'wavelength' of the sound is inversely proportional to what?

A) Amplitude

B) Frequency

C) Phase shift

D) Vertical shift

10. When mapping the habitat range of a pack of wolves, surveyors often use polar coordinates (r, ?). What does 'r' represent in this trigonometric coordinate system?

A) The angle from the north

B) The distance from the origin point

C) The height above sea level

D) The speed of the animals

11. The internal angles of a honeycomb cell are hexagonal. If you calculate the tilt of the base of a bee cell, the angle is related to the geometry that minimizes wax usage, involving which trigonometric calculation?

A) Calculating the arc length

B) Optimizing the surface area using derivatives of trig functions

C) Finding the square root of the perimeter

D) Measuring the tangent of the area

12. Light refraction as it enters a pond at an angle is governed by Snell's Law, which uses which trigonometric function?

A) Sine

B) Cosine

C) Tangent

D) Cotangent

13. If a chameleon's tongue strikes an insect at a specific angle, the horizontal velocity component is calculated by multiplying the total velocity by the...

A) Sine of the angle

B) Cosine of the angle

C) Tangent of the angle

D) Secant of the angle

14. When calculating the area of a triangular meadow using two sides and the included angle, which formula is used?

A) $\text{Area} = 0.5 * \text{base} * \text{height}$

B) $\text{Area} = 0.5 * a * b * \sin(C)$

C) $\text{Area} = a * b * \cos(C)$

D) $\text{Area} = \tan(a) * b$

15. The path of a spider's silk thread hanging in the wind can sometimes be modeled by a catenary curve, which is defined using which type of functions related to trigonometry?

A) Hyperbolic functions

B) Inverse tangent functions

C) Circular functions

D) Polynomial functions