Trigonometry in Human Anatomy and Physiology

Trigonometry · Practice Test · 14 Questions

1. When analyzing the force exerted by a muscle on a bone during a specific joint movement, such as the biceps brachii flexing the elbow, trigonometry is used to resolve the muscle's force vector into components parallel and perpendicular to the bone. If a muscle exerts a force of 100 N at an angle of 30 degrees relative to the forearm's long axis, what is the magnitude of the force component that contributes to pronation/supination (perpendicular to the forearm)?

A) 50 N
B) 86.6 N
C) 100 N
D) 0 N

2. In the study of gait analysis, the angle of the knee joint during the stance phase can be approximated using trigonometric relationships. If a person's heel strikes the ground and the tibia makes an angle of 15 degrees with the vertical, what is the angle of flexion in the knee, assuming the femur is perfectly vertical?

A) 15 degrees
B) 75 degrees
C) 90 degrees
D) 105 degrees

3. The curvature of the spine can be quantified using trigonometry to assess spinal alignment and potential deformities like scoliosis. If a radiograph measures the angle of a Cobb angle as 40 degrees, this directly represents the:

A) Lateral deviation of the vertebrae
B) Rotational deformity of the spine
C) Sagittal plane curvature
D) Angle of inclination of the sacrum

4. In ophthalmology, the angle of deviation of an eye due to strabismus can be measured in prism diopters, which are related to the tangent of the angle. A deviation of 10 prism diopters corresponds approximately to an angle of:

A) 5.7 degrees
B) 10 degrees
C) 0.57 degrees
D) 0.10 degrees

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5. The angle of repose of a material refers to the steepest angle at which a material can be piled without slumping. In the context of prosthetics, understanding the angle of repose of bone graft materials is crucial for stability. If a bone graft material has an angle of repose of 35 degrees, this angle is:

A) The angle between the heap's surface and the horizontal
B) The angle of shear strength
C) The angle of internal friction
D) All of the above

6. During a squat exercise, the angle of the knee and hip joints changes dynamically. If a person squats down to a point where the angle between the thigh and the shin is 90 degrees, what is the angle of flexion at the knee?

A) 45 degrees
B) 90 degrees
C) 135 degrees
D) 180 degrees

7. In dental mechanics, the forces exerted by orthodontic appliances are often analyzed using trigonometry. If an archwire applies a force that causes a tooth to rotate by 10 degrees, and the point of force application is 15 mm from the tooth's center of rotation, the moment generated can be calculated using trigonometric principles, where the angle is critical for determining the lever arm's effective length.

A) The angle of rotation is directly proportional to the moment
B) The angle of rotation is inversely proportional to the moment
C) The angle of rotation affects the perpendicular distance for calculating torque
D) The angle of rotation is irrelevant to moment calculation

8. The angle of tilt of the pelvis during activities like walking or standing is a significant biomechanical parameter. If the pelvis tilts forward by 10 degrees from a neutral position, and we consider the lumbar spine's lordotic curve, the angle of tilt directly influences the:

A) Shear forces on the intervertebral discs
B) Compression forces on the anterior vertebral bodies
C) Angle of flexion in the hip joints
D) All of the above

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9. In audiology, the directionality of sound reception by the pinna (outer ear) involves complex trigonometric calculations to determine how different frequencies are perceived based on the angle of incidence of sound waves. The concha, a prominent part of the pinna, can cause a phase difference in sound waves reaching the eardrum, which is dependent on the:

A) Amplitude of the sound wave
B) Frequency of the sound wave
C) Wavelength and path difference
D) Intensity of the sound wave

10. The angle of incidence and reflection of light are fundamental to understanding how optical instruments in medicine, such as endoscopes, work. If a light ray enters an optical fiber at an angle of 60 degrees to the normal, its angle of reflection inside the fiber will be:

A) 30 degrees
B) 60 degrees
C) 90 degrees
D) 120 degrees

11. In sports biomechanics, analyzing the trajectory of a projectile, like a thrown ball, involves physics principles closely related to trigonometry. If a professional baseball pitcher throws a ball at an angle of 45 degrees above the horizontal, this angle is approximately optimal for:

A) Maximum horizontal distance (range) in the absence of air resistance
B) Maximum vertical height
C) Minimum time of flight
D) Maximum velocity at impact

12. The angle of dangle of a leg in a reclining position, often considered in physiotherapy for venous return, refers to the angle between the leg and the horizontal. If a patient's leg is elevated 30 degrees above the horizontal, the angle of dangle is:

A) 60 degrees
B) 90 degrees
C) 120 degrees
D) 30 degrees

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13. In the study of joint kinematics, the angle of abduction of the shoulder is a crucial measure. If a person raises their arm directly sideways to be parallel with the floor, the angle of abduction from the resting position (arm alongside the body) is:

A) 0 degrees
B) 45 degrees
C) 90 degrees
D) 180 degrees

14. The angle of attack of an airfoil is critical in aerodynamics, which has parallels in understanding the airflow around respiratory passages. If air enters the trachea at a certain angle, this angle influences the flow dynamics. A zero angle of attack means the airflow is:

A) Perpendicular to the airway's surface
B) Parallel to the airway's surface
C) At an oblique angle to the airway's surface
D) Turbulent

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