

ENGINEERING ENTRANCE EXAMINATION
QUESTIONS IN MATHEMATICS
NOTE: ANSWER ANY 11 QUESTIONS OUT OF THE 16 QUESTIONS

1. Find the determinant of $\begin{vmatrix} 7 & 3 & 1 \\ 1 & 0 & 9 \\ 5 & 1 & 6 \end{vmatrix}$

2. Find y'' for the function, $y(x) = 7x^5 - 2x^3 + x^2 + 57$

3. Use Partial Fraction Decomposition to decompose $\frac{2x-1}{x^2-13x+42}$

4. Find the center and radius of a circle given the equation $x^2 - 20x + y^2 + 6y = 19$

5. Determine $f'(x)$ given $f(x) = x^2 \cos 2x - 4x^3 \sin 2x$

6. Simplify the expression $7 + \ln 8 + \ln(x+3) - \ln 23 = 0$ and solve. Round answer to the nearest hundredth.

7. Evaluate $\lim_{x \rightarrow 3} \frac{x^3 + 2x - 17}{5x^2 + 1}$

8. Find the equation of a line perpendicular to a line that passes through the points (3,-1) and (2, 5).

9. Evaluate $\lim_{x \rightarrow 0} \frac{x^5 - x^3 + 17x + 13}{4\cos x + 2\sin x - 3}$

10. Evaluate $\int_0^4 8y^3 + 3y^2 - y - 1$

11. A growth curve is given by $A = 10e^{2t}$. At what value of t is A = 100?

12. If $y(x) = \frac{x^2 - 4x + 7}{e^{7x}}$, determine $y'(x)$.

13. Using integration by parts, simply $\int 4x \cos(2 - 3x) dx$

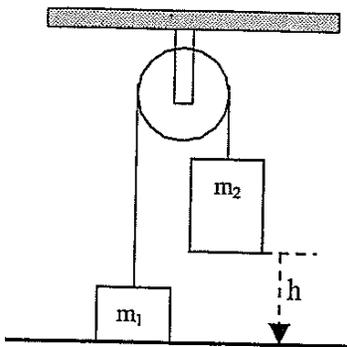
14. Evaluate $\int_3^8 \frac{x^3(x^2-8x-20)}{(x-10)} dx$

15. $\int \frac{1}{x} dx$

16. If $y''(x) = 7x^3 + 4x^2 + x - 17$, then determine $y(x)$

ENGINEERING ENTRANCE EXAMINATION
QUESTIONS IN PHYSICS
NOTE: ANSWER ANY 11 QUESTIONS OUT OF THE 16 QUESTIONS

1. An object is fired straight up at a speed of 4.9m/s . Determine the maximum altitude and the time it takes to reach that height. Ignore air resistance.
2. Calculate the power output of a shot putter who takes 1.2 seconds to accelerate a 7.27 kg shot from rest to 14 m/s , while raising it 0.8m . Ignore power produced by acceleration of the body.
3. A bullet leaves a rifle with a muzzle velocity of 521 m/s . While accelerating through the barrel of the rifle, the bullet moves a distance of 0.84m . Determine the acceleration of the bullet. Assume uniform acceleration.
4. Two masses are connected by a light string passing over a light, frictionless pulley (known as an "Atwood Machine"). Mass m_1 is 5kg and mass m_2 is 8kg . Mass m_2 is initially 3m above the floor when the system is released. What is the speed of m_1 just as m_2 strikes the floor.



5. A 35 kg crate undergoes a horizontal acceleration of 1.5 m/s^2 on a level surface when pulled by a 65.0 N force. What is the coefficient of kinetic friction between the crate and the surface?

6. The highest barrier that a projectile can clear is 14 m, when the projectile is launched at an angle of 30.0 degrees above the horizontal. What is the projectile's launch speed?

7. Rocket –powered sleds are used to test the human response to acceleration. If a rocket-powered sled is accelerated to a speed of 444 m/s in 1.83 seconds, what is the distance that the sled travels?

8. Two long straight wires carrying the same current I and separated by a distance r exert a force F on each other. The current is increased to $4I$ and the separation is reduced to $r/6$. What will be the force between two wires?

9. A man stands 40 m from a flag pole. At eye level, the angle to the top of the flag pole with respect to the man's eyes is 25 degrees. How high is the flag pole if the distance from the ground to his eyes is 1.8 m.

10. A heat engine operates in a Carnot cycle between the temperatures 52°C and 475°C . During each cycle, it absorbs 6×10^3 calories of heat from the high-temperature reservoir. If the duration each cycle is one seconds, determine how much heat is expelled during each cycle.
11. At a distance 3m from a pneumatic hammer, the sound level is 150dB and the sound intensity is 1.00 W/m^2 . At 45m from the hammer, what is the sound level in dB.
12. A rocket is fired vertically upwards with initial velocity 80 m/s at the ground level. Its engines then fire and it is accelerated at 4 m/s^2 until it reaches an altitude of 1000 m. At that point the engines fail and the rocket goes into free-fall. Disregard air resistance. Determine the velocity just before it collides with the ground.
13. A body of mass 5 kg slides a distance of 6 m down a rough Inclined plane 30 degree. Then it moves on frictionless horizontal surface and compresses a spring. The coefficient of kinetic friction is 0.1 and the spring constant is 300 N/m. Find the maximum compression of the spring.
14. At an amusement park there is a roller coaster ride. After the first drop, riders are moving at the speed of 120 km/h, entering an underground tunnel. Given the fact that the roller coaster was moving at a speed of 4 km/h at the top of the hill, determine the vertical drop that these participants fell through. Neglect friction.

15. A 2000 kg truck is traveling east through an intersection at 2 m/s when it is hit simultaneously from the side and the rear. One car is a 1000 kg compact traveling north at 5 m/s. The other car is a 1500 kg midsize traveling east at 10 m/s. The three vehicles become entangled and slide as one body. What are their speeds and direction just after the collision?

16. Given vectors: $A=3i-2j+9k$ and $B=6i+5j-4k$. Find a unit vector perpendicular to both vectors.

