

Question 1:

(a)[3 points] Determine y' if $y = 5x^4 - \pi x + 6\sqrt{x} - \sqrt{2}$

(b)[3 points] Determine $\frac{dy}{dx}$ where $y = \left(3x^2 + \frac{1}{x}\right) \csc x$

(c)[4 points] Determine $f'(x)$ if $f(x) = \frac{\sec x - \sqrt[3]{x}}{\tan x - 2x^{1/2}}$

Question 2:

(a)[3 points] Find $\frac{dy}{dx}$ if $y = \sqrt[3]{x + \sqrt{x}}$

(b)[3 points] Find $\frac{dy}{dx}$ if $y = \sin(\sqrt{7x + \cos x})$

(c)[4 points] Compute $g''(\pi)$ if $g(\theta) = \theta^2 \cos \theta$

Question 3:

- (a)[5 points] Determine the values of a and b for which the line $y = -2x + b$ is tangent to the parabola $y = ax^2$ when $x = 2$.

- (b)[5 points] A particle moving along a straight line has position at time t given by $s(t) = 2t^3 - 12t^2 + t + 2$. Here $t \geq 0$ is in seconds and position is in metres. Determine the velocity of the particle when the acceleration is 0 m/s^2 .

Question 4:

(a)[4 points] Determine $f'(x)$ if $f(x) = (1 - x^2) \sin\left(\frac{1}{x}\right)$

(b)[6 points] Find an equation of the tangent line to the curve $x \sin(y - xy) = \frac{x - y}{y}$ at the point $(1, 1)$.

Question 5 [10 points]: A ball is falling vertically to the ground near a 10 m tall lamp post. It is night time, so the light atop the lamp post casts the ball's shadow on the ground. At a certain instant the ball is 5 m above the ground and falling at 4 m/s toward a spot on the ground 6 m from the base of the lamp post. How fast is the shadow moving along the ground at that instant? State units with your answer.

