

Question 1:

(a) Determine $\sin(\sin^{-1}(3/4))$

[2]

(b) Determine $\arccos(\cos(7\pi/4))$

[4]

(c) Let $f(x) = x \tan^{-1}(x) - \frac{1}{2} \ln(1 + x^2)$. Evaluate $f'(1)$.

[4]

Question 2:

- (a) Find all values of x at which the tangents to $f(x) = \sinh^2(x)$ have the same slope as the tangents to $g(x) = \cosh(x)$.

[5]

- (b) Evaluate the following limit: $\lim_{x \rightarrow 0^+} \tanh\left(\frac{1}{x}\right)$.

[5]

Question 3: Find the following limits if they exist:

(a) $\lim_{x \rightarrow 0} \frac{x^2}{1 - \cos(x)}$

[3]

(b) $\lim_{x \rightarrow 1} \frac{e^x - x}{e^x + x - 1}$

[3]

(c) $\lim_{x \rightarrow 0^+} \sin(x) \ln(x)$

[4]

Question 4: Find the following limits if they exist:

(a) $\lim_{x \rightarrow 0^+} x^{(x^2)}$

[5]

(b) $\lim_{x \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{\sin(x)} \right)$

[5]

Question 5:

(a) Determine $f(x)$ if

$$f''(x) = 3\sqrt{x} - \frac{1}{x^2}, \quad f'(1) = 3, \quad f(1) = 0$$

[5]

(b) A raindrop falls with acceleration $a(t) = 9 - 0.9t$ m/s². If $t = 0$ corresponds to the time at which it forms 500 m above the ground, determine how far the raindrop falls during the first 10 seconds.

[5]