Question 1:

(a)[3] Simplify $\csc(\arctan(a/b))$. Your final answer should not contain any trigonometric or inverse trigonometric functions.

(b)[4] Determine an equation of the tangent line to the curve $y = 3\arccos(x/2)$ at the point where $x = 1$.

(c)[3] Determine $\lim_{x\to 0^+} \arctan\left(1/\sqrt{x}\right)$.

Question 2:

(a)[4] Let $f(x) = \sinh(x + \sinh^2 x)$. Determine $f'(0)$.

(b)[6] Determine the two values of x at which the tangent lines to the curve $y = \sinh x$ have slope 2 .

Question 3:

(a)[3] Evaluate $\lim_{x\to 1} \dfrac{\ln x}{\sin(\pi x)}$.

(b)[4] Evaluate $\lim_{x\to -\infty} x^2 e^{2x}$.

(c)[3] Evaluate $\lim_{x\to \infty} x^{1/(1+\ln x)}$.

Question 4:

(a)[3] Evaluate $\lim_{x\to 1^+}\left(\frac{x}{x-1}-\frac{1}{\ln x}\right)$.

(b)[3] Determine the most general antiderivative of $f(x)=\frac{2}{\sqrt{1-x^2}}+\pi\sin x$.

(c)[4] Determine $f(x)$ if $f''(x)=\frac{-1}{x^2}$ where $f'(1)=2$ and $f(1)=4$.

Question 5:

(a)[4] The limit

$$\lim_{n\to\infty} \sum_{i=1}^{n} \left[1 + \left(\frac{i}{n}\right)^2\right] \left(\frac{1}{n}\right)$$

represents the area between the graph of $y = f(x)$ and the x-axis over a particular interval $[a, b]$. Identify the function $f(x)$ and the interval $[a, b]$.

(b)[6] Use six subintervals and right endpoints to approximate the area under the graph of $y = \sin^2 x$ over the interval $[0, \pi]$.