Question 1:

(a)[3] Evaluate $\arccos(-1/2)$.

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

(c)[4] Determine an equation of the tangent line to the graph of $f(x) = \arcsin(x) + \arccos(x)$ at the point where $x = 0$.

Question 2:

(a)[5] Find all values of x for which $\operatorname{sech}(\ln x) = 1$.

(b)[5] Let $y = (\sinh(x) + \cosh(x))^2$. Compute and simplify $y''' - 8y$ (Hint: avoid expanding the square terms.)

Question 3:

(a)[5] Evaluate the limit if it exists:

$$\lim_{x\to 0} \frac{x\cos(x)}{\ln(1+x)}$$

(b)[5] Evaluate the limit if it exists:

$$\lim_{x\to \infty} \frac{e^{4x}-1-4x}{x^2}$$

Question 4:

(a)[5] Evaluate the limit if it exists:

$$\lim_{x\to 1^+}\left(\frac{x}{x-1}-\frac{1}{\ln x}\right)$$

(b)[5] Evaluate the limit if it exists:

$$\lim_{x\to 0^+}\left(\cosh\left(x\right)\right)^{1/x}$$

Question 5:

(a)[5] An object initially $s(0) = 2$ m above the surface of the moon is projected vertically upward with an initial velocity of $v(0) = 3$ m/s. Using the fact that acceleration due to gravity on the moon is $a(t) = -1.6$ m/s^2, derive the formula for $s(t)$, the height of the object above the moon's surface at time t seconds.

(b)[5] The rate of increase of a growing town's population is determined at five points in time, resulting in the following data:

t (years)	0	0.5	1	1.5	2
$r(t)$ (people per year)	60	80	90	110	130

Assuming that $r(t)$ is an increasing function of time, give an upper estimate of the population increase over the period $t = 0$ to $t = 2$.