FRQ #4 – Symbolic Manipulation

NO CALCULATOR Name: _____ **CA #1**

Answer the following practice FRQ #4 question. Grade using the scoring rubric.

1.

(A) The functions g and h are given by

$$g(x) = \frac{(e^x)^3}{e^2} \qquad h(x) = \arccos(2x + 1)$$

(i) Solve $g(x) = \sqrt{e}$ for values of x in the domain of g.

(ii) Solve $h(x) = \frac{\pi}{3}$ for values of x in the domain of h.

(B) The functions j and k are given by

$$j(x) = \frac{(\cos^2 x)+(\sin^2 x)}{\cos^2 x} - 1 \qquad k(x) = \ln(x + 1) - 2\ln(x) + \ln(2x)$$

(i) Rewrite $j(x)$ as a single term involving $\tan^2 x$.

(ii) Rewrite $k(x)$ as a single natural logarithm without negative exponents in any part of the expression. Your result should be in the form of $\ln(expression)$.

(C) The function m is given by

$$m(x) = \cos^2(x) + 2\cos(x)$$

Find all input values in the domain of m that yield on output value of -1.

Your Score: ____ out of 6 points

Answers to FRQ #4 Symbolic Manipulation CA #1

Model Solution	Scoring
A i. $g(x) = \sqrt{e}$ $\sqrt{e} = \frac{(e^x)^3}{e^2}$ $\sqrt{e} = \frac{e^{3x}}{e^2}$ $e^2\sqrt{e} = e^{3x}$ $e^2 e^{\frac{1}{2}} = e^{3x}$ $e^{\frac{5}{2}} = e^{3x}$ $\ln e^{\frac{5}{2}} = \ln e^{3x}$ $\frac{5}{2} = 3x$ $\frac{5}{6} = x$	Solution to $g(x) = \sqrt{e}$ **1 point**
ii. $h(x) = \frac{\pi}{3}$ $\frac{\pi}{3} = \arccos(2x+1)$ $\cos\left(\frac{\pi}{3}\right) = \cos(\arccos(2x+1))$ $\frac{1}{2} = 2x+1$ $-\frac{1}{2} = 2x$ $-\frac{1}{4} = x$	Solution to $h(x) = \frac{\pi}{3}$ **1 point**
B i. $j(x) = \frac{1}{\cos^2 x} - 1$ $j(x) = \sec^2 x - 1$ $j(x) = \tan^2 x$	Expression for $j(x)$ **1 point**
ii. $k(x) = \ln(x+1) - 2\ln(x) + \ln(2x)$ $k(x) = \ln(x+1) - \ln(x)^2 + \ln(2x)$ $k(x) = \ln\left(\frac{(x+1)(2x)}{x^2}\right)$ $k(x) = \ln\left(\frac{(x+1)(2)}{x}\right)$ $k(x) = \ln\left(\frac{2x+2}{x}\right)$	Expression for $k(x)$ **1 point**
C $m(x) = -1 \Rightarrow \cos^2(x) + 2\cos(x) = -1$ $\cos^2(x) + 2\cos(x) + 1 = 0$ $(\cos x + 1)(\cos x + 1) = 0$ $\cos x = -1$ $\cos^{-1}(\cos x) = \cos^{-1}(-1)$ $x = \pi + 2\pi n$, where n is any integer	One value of x **1 point** All values of x **1 point**