

#### 4. Directions:

- Unless otherwise specified, the domain of a function  $f$  is assumed to be the set of all real numbers  $x$  for which  $f(x)$  is a real number. Angle measures for trigonometric functions are assumed to be in radians.
- Solutions to equations must be real numbers. Determine the exact value of any expression that can be obtained without a calculator. For example,  $\log_2 8$ ,  $\cos\left(\frac{\pi}{2}\right)$ , and  $\sin^{-1}(1)$  can be evaluated without a calculator.
- Unless otherwise specified, combine terms using algebraic methods and rules for exponents and logarithms, where applicable. For example,  $2x + 3x$ ,  $5^2 \cdot 5^3$ ,  $\frac{x^5}{x^2}$ , and  $\ln 3 + \ln 5$  should be rewritten in equivalent forms.
- For each part of the question, show the work that leads to your answers.

A. The functions  $g$  and  $h$  are given by

$$g(x) = e^{2x}$$

$$h(x) = \log_2(5x)$$

- Solve  $g(x) = \frac{1}{e^6}$  for values of  $x$  in the domain of  $g$ .
- Solve  $h(x) = 3$  for values of  $x$  in the domain of  $h$ .

B. The functions  $j$  and  $k$  are given by

$$j(x) = 7^{(3x+1)} \cdot 7^x$$

$$k(x) = \sin(2x) \sec x$$

- Rewrite  $j(x)$  as an expression of the form  $7^{(\text{expression})}$ .
- Rewrite  $k(x)$  as an expression in which  $\sin x$  appears exactly once and no other trigonometric functions are involved.

C. The function  $m$  is given by  $m(x) = \tan^2(3x)$ .

Find all input values for  $m$  in the interval  $\left[0, \frac{\pi}{2}\right]$  that yield an output value of 1.

**STOP**  
**END OF EXAM**