

Comprehensive Final Exam Calculus-I MATH 140 20-questions

1. Evaluate analytically

$$\lim_{x \rightarrow 0^+} (\csc x - \cot x)$$

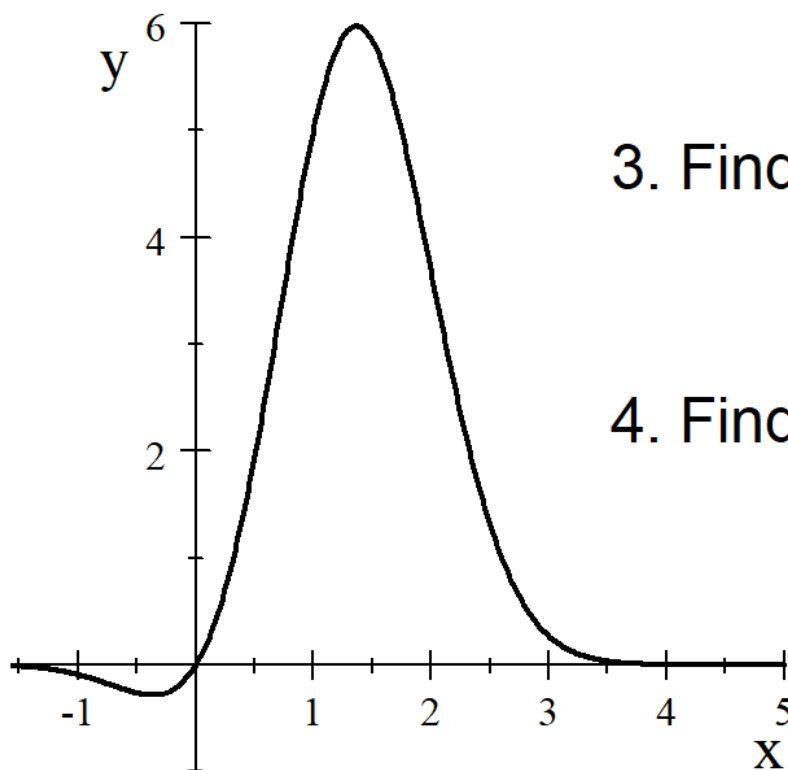
2.

Evaluate analytically

$$\lim_{x \rightarrow 0^+} (x + \cos x)^{1/x}$$

write the exact value

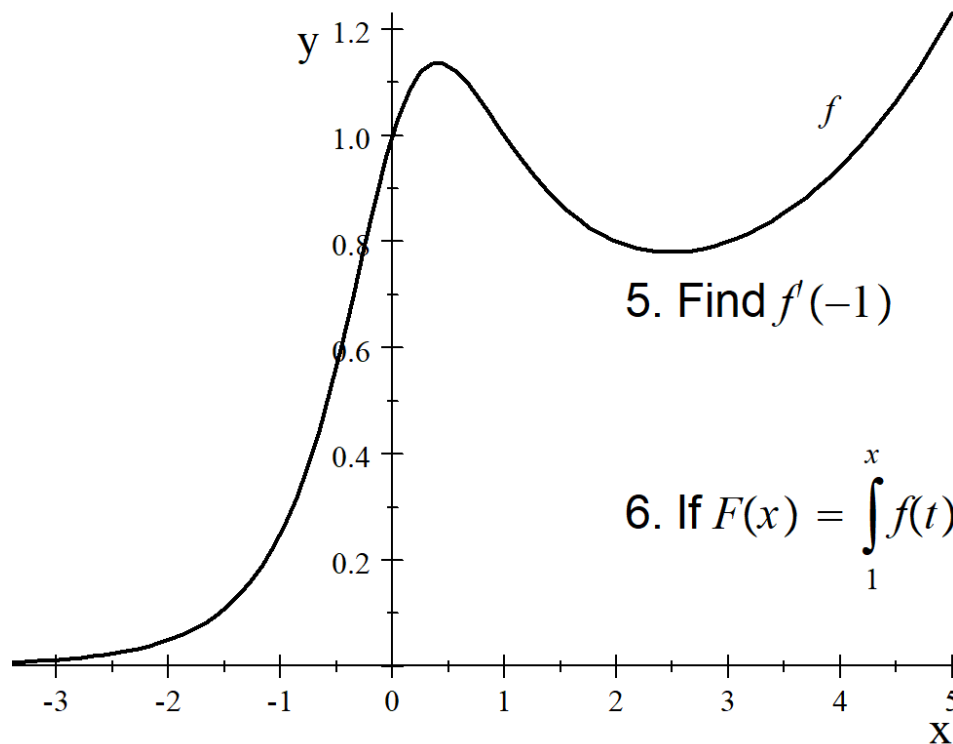
Refer to the graph of the function f as shown below for the questions 3-4, write the steps to obtain the answer



3. Find $\lim_{x \rightarrow 1} \frac{x+2}{f(x)}$

4. Find $\lim_{x \rightarrow 0} \frac{f(x)}{x}$

Refer to the graph of the function f as shown below for the questions 5-6, explain your answer



5. Find $f'(-1)$

6. If $F(x) = \int_1^x f(t)dt$, find $F'(1)$

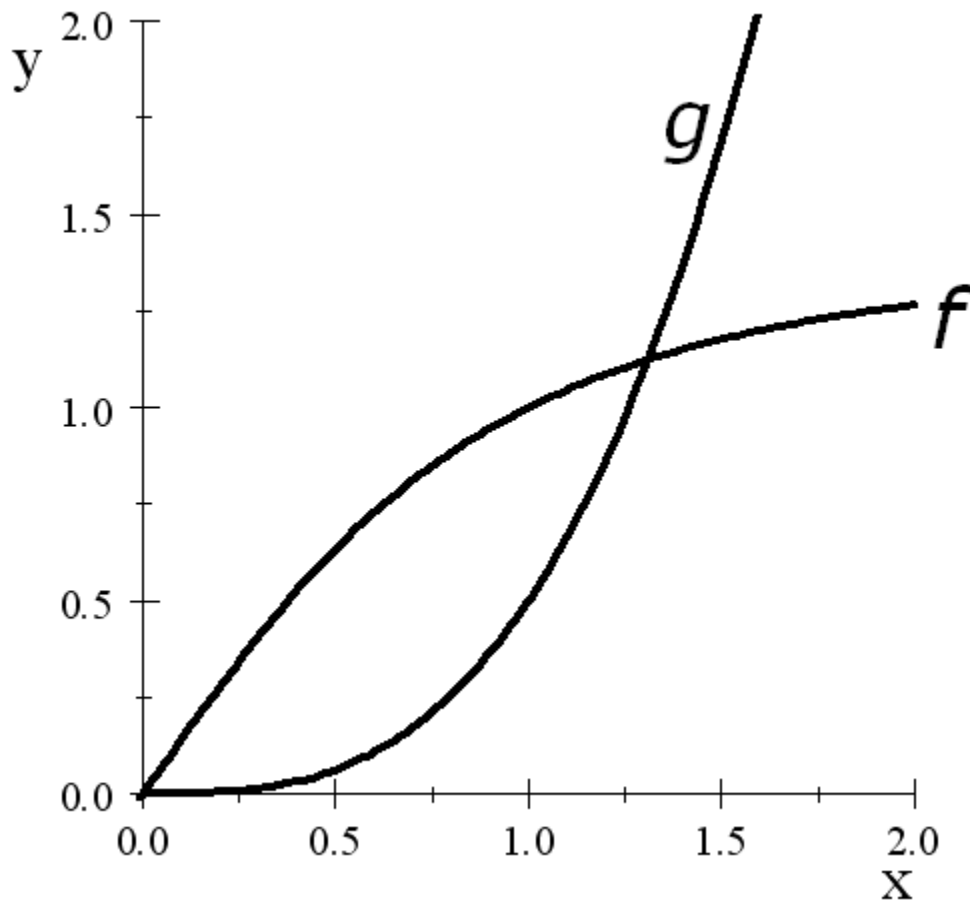
7. Find an equation of the tangent line to the graph of

$$y = 2e^{-x} \cos x \quad \text{at } (0, 2).$$

8.

Find an equation of the tangent line to the graph of $x^2e^y + y\ln x = 1$ at $(1,0)$

9. Graphs of a function f and a function g are shown below.



If $h(x) = f(x)g(x)$ find $h'(1)$

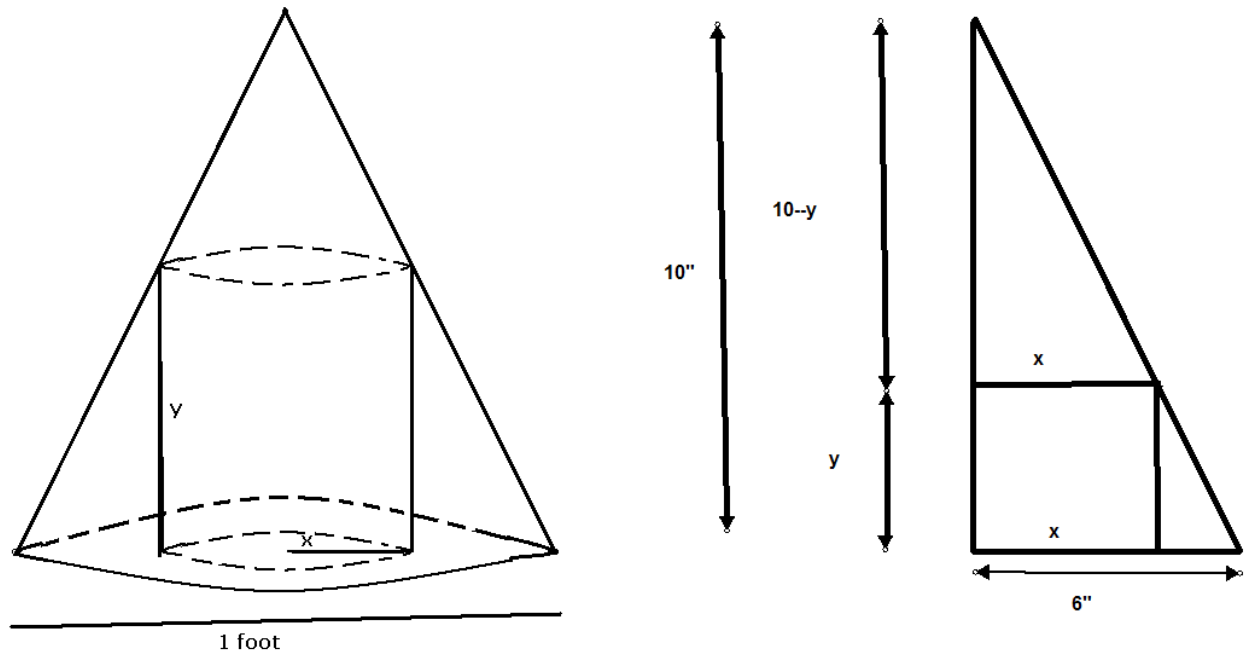
and also find $(g \circ f)'(1)$

10-14

For the function $f(x) = x^{2/3}(x^2 - 2x - 6)$

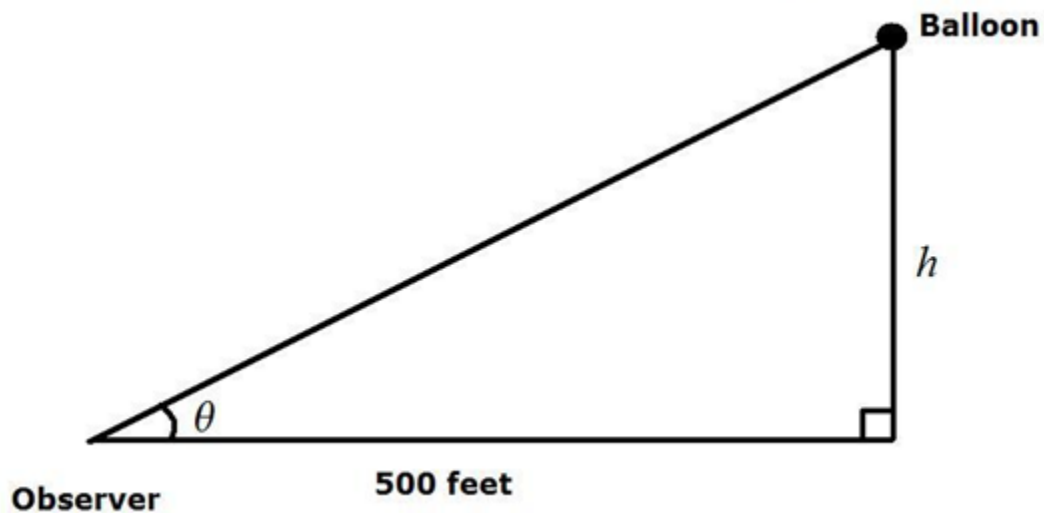
- a) Find $f'(x)$
- b) Find $f''(x)$
- d) Find the critical numbers
- e) Find the local extrema
- f) Find the intervals on which the function is concave up or concave down
- g) Write the coordinates of the x-intercepts and the y-intercept

15. Find the radius and the height of the right circular cylinder of the largest volume that can be inscribed in a right circular cone with radius 6 inches and height 10 inches.



Volume of a cylinder $\pi(\text{radius})^2(\text{altitude})$

16. A hot air balloon is rising vertically from a level field from a point that is 500 feet from an observer. At the instant, when the angle of elevation is 40° , the angle of elevation is increasing at a rate of 0.08 radians per minute. How fast is the balloon rising at that moment?



17. Use the Newton's method to find the solution of the equation

$e^x - \tan x = 0$ with -3 as the starting guess, show at least five values of the iterations.

18. Evaluate $\int \frac{x^4 + x^2 + 1}{\sqrt{x}} dx$

19. Evaluate

Evaluate $\int (e^{-x} + \sin x) dx$

20. Find the exact value of

Find the exact value of $\int_{-5}^5 |x^2 - 4x - 12| dx$