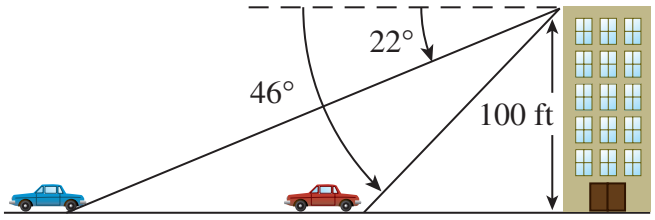
(5) 1. Use Cramer's rule to find z in the following linear system:

$$\begin{aligned} 3x + 2y - 5z &= -1 \\ 2x - 3y - z &= 11 \\ 5x - 2y + 7z &= 9 \end{aligned}$$

(4) 2. From the top of the 100-ft-tall Place Ville-Marie a man observes a car moving **toward** the building. If the angle of depression of the car changes from 22° to 46° during the period of observation, how far does the car travel? (Round your answer to two decimal places.)



(7) 3. A carnival Ferris wheel with a radius of 14m makes one complete revolution every 16 seconds. The bottom of the wheel is 1.5m above the ground. Lili is at the top of the wheel when a stop watch is started. Let $y(t)$ denote how high Lili is above ground (in meters) after t seconds.

(a) What is the period of the function $y(t)$?

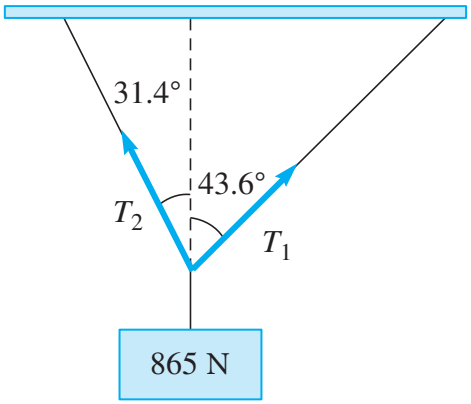
(b) What is the amplitude of the function $y(t)$?

(c) What is the midline of the function $y(t)$?

(d) Find a possible equation for the function $y(t)$.

(e) How high above the ground will Lili be after 1 minute and 7 seconds? (Round your answer to two decimal places.)

(5) 4. A 865-N crate of building supplies is hanging from two cables as shown below. Find the tensions T_1 and T_2 assuming that the forces are in equilibrium.



(8) 5. Solve the following equations for x such that $0 \leq x < 2\pi$:

(a) $\sec^2(x) - 2\tan(x) = 4$

(b) $\sin(2x) + \sin(x) = 0$

(5) 6. Find all the possible solutions of the following equation:

$$\ln(x) + \ln(x-1) = \ln(3x+12)$$

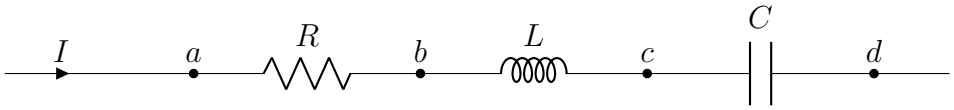
(6) 7. Evaluate the following, and give your answer in rectangular form $x + yj$.

(a) $\dfrac{j^3 - j^{12} + 3}{2 + 3j} =$

(b) $(-1+j)^9 =$

(6) 8. Find all 3 cube roots of $-j$. Give your answers in rectangular form $x + yj$.

(6) 9. Consider the electrical circuit below:



The current is $I = 3.00\text{A}$, the resistance is $R = 15.0\Omega$, the reactance of the inductor is $X_L = 25.0\Omega$ and the reactance of the capacitor is $X_C = 50.0\Omega$.

(a) Determine the impedance Z.

(b) Determine the magnitude of the voltage across the RLC combination (between points a and d).

(c) Determine if the voltage leads or lags the current, and by what angle.

(9) 10. For the function f given in the diagram below, find each of the following, indicating *DNE* or ∞ or $-\infty$ or *undefined*, as appropriate.

$\lim_{x \to -2^+} f(x) =$

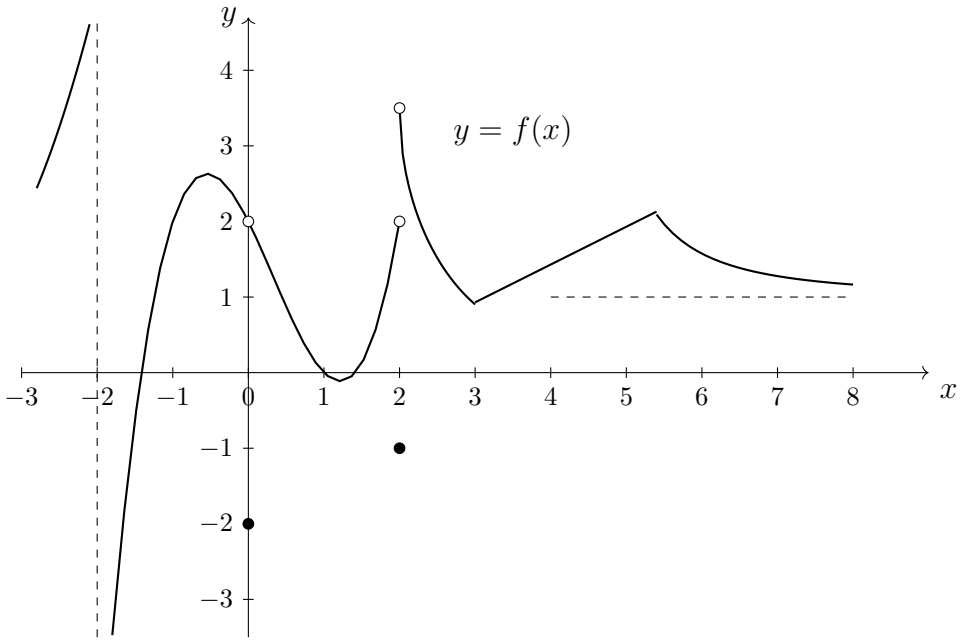
$\lim_{x \to 2^-} f(x) =$

$\lim_{x \to 2} f(x) =$

$\lim_{x \to 0} f(x) =$

$\lim_{x \to \infty} f(x) =$

$f(2) =$



x-values of points of discontinuity are: _____

(12) 11. Evaluate the following limits:

(a) $\lim_{x\to 1} \dfrac{x^2+3x-4}{3x^2-x-2}$

(b) $\lim_{x\to -4} \dfrac{x^2-16}{x^3+64}$

(c) $\lim_{x\to -\infty} \dfrac{\sqrt{16x^4+7x-3}}{9x^2+5}$

(d) $\lim_{x\to 2^+} \dfrac{x^4+x^2+3}{4-x^2}$

(5) 12. Find the derivative of $f(x)=\sqrt{4x+5}$ **using only the limit definition of the derivative**.

(12) 13. Find the derivative of the following functions. **Do not simplify your answers**.

(a) $y = 3^x + 12\sqrt[3]{x} - \dfrac{1}{x^3} - \log_3 x + \ln 3$

(b) $y = e^{3x}\sin(x^5+6x)$

(c) $y = 5\tan(\cos(x))$

(d) $y = \ln\left(\dfrac{(x^2-9)^4\sec^3 x}{x^9\sqrt{4x+7}}\right)$ (**Simplify first using properties of the logarithm**.)

(5) 14. Given the equation $x^3y+y^5=2x^5+32$, find y' using implicit differentiation.

(5) 15. Find an equation of the tangent line to the curve $y=\dfrac{x^2}{\sqrt{x^2+3}}$ at $x=1$.

ANSWERS

1. $z=\dfrac{-8}{27}$
2. $x = 150.94$ ft
3. (a) $p=16$
   (b) $|a|=14$
   (c) $y=15.5$
   (d) $y(t)=14\sin\left(\dfrac{\pi}{8}t+\dfrac{\pi}{2}\right)+15.5$
   (e) $y(67)=20.86$ m
4. $T_1=467$ N and $T_2=618$ N
5. (a) $x=1.25$ rad, $x=4.39$ rad, $x=\dfrac{3\pi}{4}$ and $x=\dfrac{7\pi}{4}$
   (b) $x=0,\ \dfrac{2\pi}{3},\ \dfrac{4\pi}{3},\ \pi$
6. $x=6$
7. (a) $\dfrac{1}{13}-\dfrac{8}{13}j$
   (b) $-16+16j$

8. the cube roots of $-j$ are
$$j,\ -\frac{\sqrt{3}}{2}-\frac{1}{2}j,\ \frac{\sqrt{3}}{2}-\frac{1}{2}j$$

9. (a) $z = 15.0 - 25.0j$
   (b) $|V_{RLC}| = 87.5$ V
   (c) Voltage lags the current by $59.0°$.

10. $\lim\limits_{x\to -2^+} f(x) = -\infty$ $\lim\limits_{x\to 2^-} f(x) = 2$ $\lim\limits_{x\to 2} f(x) = \text{DNE}$
    $\lim\limits_{x\to 0} f(x) = 2$ $\lim\limits_{x\to \infty} f(x) = 1$ $f(2) = -1$

    x-values of points of discontinuity are: $-2,\ 0,\ 2$

11. (a) 1 (b) $-\frac{1}{6}$ (c) $\frac{4}{9}$ (d) $-\infty$

12. Show that $\dfrac{f(x+h)-f(x)}{h} = \dfrac{\sqrt{4(x+h)+5}-\sqrt{4x+5}}{h} = \cdots = \dfrac{4}{\sqrt{4(x+h)+5}+\sqrt{4x+5}}$

    Therefore the limit as h approaches zero is $f'(x) = \dfrac{2}{\sqrt{4x+5}}$

13. (a) $y' = 3^x \ln 3 + 4x^{-2/3} + 3x^{-4} - \dfrac{1}{x \ln 3}$
    (b) $y' = 3e^{3x}\sin(x^5+6x) + e^{3x}\cos(x^5+6x)(5x^4+6)$
    (c) $y' = -5\sec^2(\cos x)\ \sin x$
    (d) $y' = \dfrac{8x}{x^2-9} + 3\tan x - \dfrac{9}{x} - \dfrac{2}{4x+7}$

14. $y' = \dfrac{10x^4 - 3x^2 y}{x^3 + 5y^4}$

15. $y = \frac{7}{8}x - \frac{3}{8}$