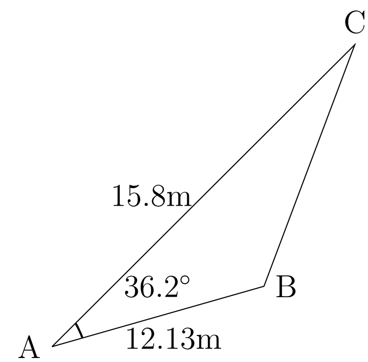
(6) 1. Solve the following system of equations **for y only** , using Cramer's Rule.

$$\begin{aligned} x + y - z &= -1 \\ 2x + 4y + 5z &= 0 \\ x + y + z &= 1 \end{aligned}$$

(6) 2. Google's self-driving car uses a laser and detects a pedestrian a distance of 15.8 m away. A split second later (assume the car has not moved), the laser rotates by 36.2° and detects a street light pole 12.13 m away. How far is the pedestrian from the street light pole? (Round appropriately, assuming accuracy is preserved in trigonometric functions.)



(5) 3. Consider the function $y = -5\sin\left(\frac{x}{3} - \frac{\pi}{6}\right) + 2$.

(a) What is the period of the function?

(b) What is the amplitude of the function?

(c) What is the phase shift of the function?

(d) What is the mid-line of the function?

(5) 4. Solve the equation for $0 \le x < 2\pi$:

$$\sin(2x) - \cos x = 0$$

(8) 5. Find all the possible solutions of the following equations:

(a) $4^{4-3x} = 32^{2x+3}$

(b) $\log_2(x) + \log_2(x+2) = \log_2(x+6)$

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

(a) $2j^6(6-3j)(j^4+j^3) \ =$

(b) $\dfrac{4j}{1-2j} \ =$

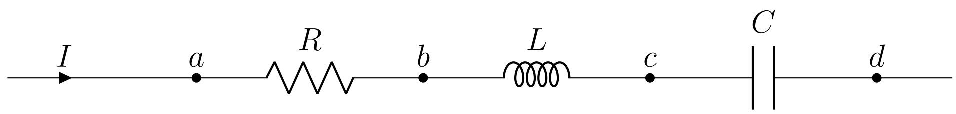
7. Evaluate the following and give your answer in **polar form** with $0 \le \theta < 360°$.

(2) (a) $\dfrac{(63\angle 141°)(5\angle 57°)}{9\angle 98°} \ =$

(2) (b) $\left(2\left(\cos(55°) + j\sin(55°)\right)\right)^9 =$

(5) (c) $1.5\angle 37.5° + 3.8\angle 146.2° =$

(8) 8. Consider the electrical circuit below:



- The current is $I = 0.250$A (with a frequency of 50.0Hz);
- The resistance is $R = 45.0\Omega$;
- The inductance is $L = 2.05$H;
- The capacitance is $C = 95.2\mu$F;

(a) Determine the reactance of the inductor X_L.

(b) Determine the reactance of the capacitor X_C.

(c) Determine the impedance Z.

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

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

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

$\lim_{x\to 5^-} f(x) =$

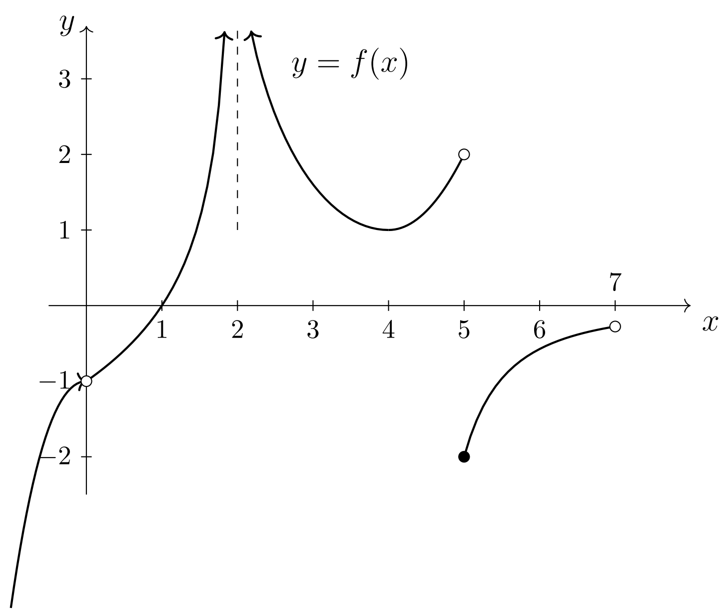
$\lim_{x\to 5^+} f(x) =$

$\lim_{x\to 5} f(x) =$

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

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

$f(0) =$



(14) 10. Evaluate the following limits:

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

(b) $\lim_{x\to 3} \dfrac{x-3}{x^3-27}$

(c) $\lim_{x\to \infty} \dfrac{(5x+1)(2x-1)}{3x^2+2x-5}$

(d) $\lim_{x\to 7^-} \dfrac{x-12}{x-7}$

(5) 11. Find the derivative of $f(x) = x^2 + 3x$, **using only the limit definition of the derivative**.

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

(a) $y = \dfrac{4}{5\sqrt[3]{x^4}} - 3^x + 2\ln(7x) - \log_7 4$

(b) $y = \left(\dfrac{\cot x + \cos x}{3x^2 + x + 1}\right)^5$

(c) $y = 5e^{x^3}\sin^2(3x-2)$

(d) $y = \ln\left(\sqrt{x^4+5}\ \sec(2x)\ \tan^4(x^5)\right)$ (**Simplify first using properties of the logarithm**.)

(6) 13. Consider the following implicit equation.

$$6x^2 + 3xy + 2y^2 + 17y = 6$$

(a) Find y' using implicit differentiation.

(b) Find an equation of the tangent line to the curve at $(-1, 0)$.

ANSWERS

1. $y = -5/2$
2. 9.4 m
3. (a) 6π (b) $|a| = 5$ (c) $\pi/2$ (d) $y = 2$
4. $x = \pi/6,\ \pi/2,\ 5\pi/6,\ 3\pi/2$
5. (a) $x = -7/16$ (b) $x = 2$
6. (a) $-6 + 18j$ (b) $-\dfrac{8}{5} + \dfrac{4}{5}j$
7. (a) $35\angle 100°$ (b) $512\angle 135°$ (c) $3.6\angle 123°$
8. (a) $X_L = 644\ \Omega$ (b) $X_C = 33.4\ \Omega$ (c) $Z = 45.0 + 611j$ (d) $|V| = 153$ V

   (e) $\theta = 85.8°$ so the voltage leads the current by $85.8°$
9. $\lim_{x\to 5^-} f(x) = 2$, $\lim_{x\to 5^+} f(x) = -2$, $\lim_{x\to 5} f(x) = \text{DNE}$

   $\lim_{x\to 2} f(x) = \infty$, $\lim_{x\to 0} f(x) = -1$, $f(0) = \text{undefined}$
10. (a) 1/3 (b) 1/27 (c) 10/3 (d) ∞
11. Show that $\dfrac{f(x+h) - f(x)}{h} = \dfrac{(x+h)^2 + 3(x+h) - (x^2+3x)}{h} = \cdots = 2x + h + 3$.

    Therefore the limit as h approaches zero is $f'(x) = 2x + 3$.
12. (a) $y' = -\frac{16}{15}x^{-7/3} - 3^x \ln 3 + \dfrac{2}{x}$

    (b) $y' = 5\left(\dfrac{\cot x + \cos x}{3x^2+x+1}\right)^4 \left(\dfrac{(-\csc^2 x - \sin x)(3x^2+x+1) - (\cot x + \cos x)(6x+1)}{(3x^2+x+1)^2}\right)$

    (c) $y' = 5(3x^2 e^{x^3}\sin^2(3x-2) + 6e^{x^3}\sin(3x-2)\cos(3x-2))$

    (d) $y' = \dfrac{4x^3}{2(x^4+5)} + \dfrac{2\sec(2x)\tan(2x)}{\sec(2x)} + \dfrac{4\sec^2(x^5)(5x^4)}{\tan(x^5)} = \dfrac{2x^3}{x^4+5} + 2\tan(2x) + \dfrac{20x^4\sec^2(x^5)}{\tan(x^5)}$
13. (a) $y' = -\dfrac{12x+3y}{3x+4y+17}$ (b) $y = \dfrac{6}{7}x + \dfrac{6}{7}$