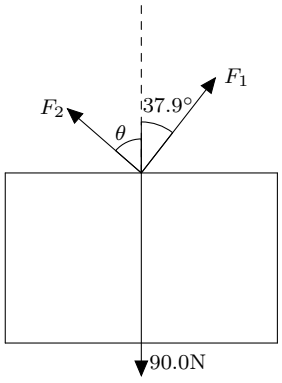
Question 1: (*3 pts*) A lawn roller is a cylinder that is 0.96m long and 0.60m in diameter. How many revolutions of the roller are needed to roll 76m^2 of lawn? (Round appropriately.)

Question 2: (*3 pts*) Solve for x **only**, using Cramer's rule:
$$\begin{cases} 2x - 5y - 3z = 7 \\ -3x + y + 2z = 0 \\ x - y + 8z = 2 \end{cases}$$

Question 3: (*5 pts*) Solve the following system of equations for each unknown:
$$\begin{cases} 2x - 4y + 8z = 24 \\ -2x + 4y - 6z = -14 \\ 3y - 3z = -9 \end{cases}$$

Question 4: (*4 pts*) A crate has a weight of 90.0N. Two ropes are attached to the crate and pulling on it. If the first rope pulls with a force $F_1 = 68.0$N and an angle of 37.9° from the vertical, what force F_2 and angle θ must the second rope have if the crate is at equilibrium? (See figure. Round appropriately.)



Question 5: (*5 pts*) The longest side of a triangle is 34.2m, and the shortest side is 22.1m. If the largest angle of the triangle is 81.3°, find the length of the third side and the measure of the two remaining angles. (Round appropriately.)

Question 6: (*4 pts*) A Ferris wheel is 40 meters in diameter, and is boarded from a platform that is 10 meters above ground. The wheel makes one full rotation every 12 minutes. At time $t = 0$ minutes, you board the Ferris wheel (from the platform). Let the function $h(t)$ denote your height above the ground (in meters) t minutes after boarding. Find:

a) the amplitude of the function $h(t)$.

b) the period of the function $h(t)$.

c) a formula for the function $h(t)$.

Question 7: (*4 pts*) Find the equation of the tangent line to the graph of $y = 7x^3 - 20x^2 + 5x + 15$ at the point $x = 1$.

Question 8: (*6 pts*) Solve the following equations for x:

a) $\log(1-x)+\log(4-x)=1$ **b)** $125^{x+2}=\left(\frac{1}{25}\right)^{3x-4}$

Question 9: (*6 pts*) Solve the following equations for x such that $0 \leqslant x < 2\pi$. Round your answers to 4 decimals.

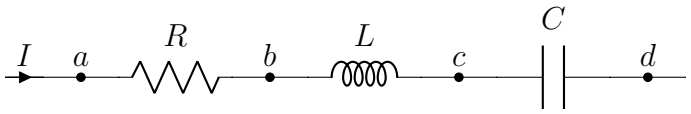
a) $\sin^2(x)-\sin(x)=2\cos^2(x)$ **b)** $2\tan^2(x)+\tan(x)=2\sec^2(x)-5$

Question 10: (*10 pts*) Perform the indicated operations, and write your answers in the rectangular form $x+yj$.

a) $(4+2j+6j^2-j^3)(5+3j^7+2j^{18}-j^{33})$ **b)** $\dfrac{(3+2j)(5-4j)}{-3+7j}$

c) $(2-3j)^{11}$ (Hint: Use DeMoivre's Theorem. Your answer should not contain any decimals.)

Question 11: (*8 pts*) Consider the electrical circuit below:



- The current is $I = 2.36\text{A}$ (with a frequency of 70.0Hz);
- The resistance is $R = 51.2\Omega$;
- The inductance is $L = 32.3\times10^{-3}\text{H}$;
- The capacitance is $C = 57.4\times10^{-6}\text{F}$;

(Round all your answers appropriately.)

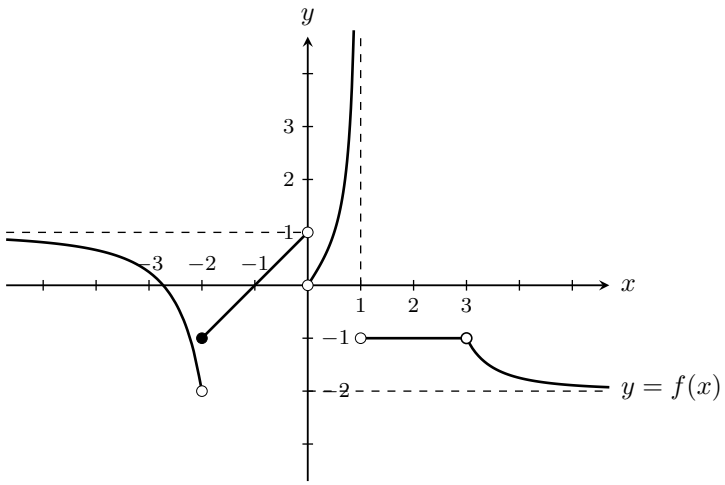
a) Determine the voltage across the resistor (between points a and b).

b) Determine the voltage across the capacitor (between points c and d).

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

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

Question 12: (*10 pts*) For the function $f(x)$ given in the graph below, find each of the following limits. Write DNE, $-\infty$ or $+\infty$ where appropriate.



a) $\lim_{x\to-\infty} f(x) =$
b) $\lim_{x\to0^-} f(x) =$
c) $\lim_{x\to3} f(x) =$
d) $\lim_{x\to1^+} f(x) =$
e) $\lim_{x\to0^+} f(x) =$
f) $\lim_{x\to1^-} f(x) =$
g) $\lim_{x\to-2} f(x) =$
h) $\lim_{x\to+\infty} f(x) =$
i) List the points of discontinuity

Question 13: (*12 pts*) Evaluate the following limits:

a) $\lim_{x\to-2} \dfrac{2x^3+5x^2-4}{4x^2+7x-2}$ **b)** $\lim_{x\to3^+} \dfrac{\frac{2}{x-4}+2}{x^2-x-6}$

c) $\lim_{x\to+\infty} \dfrac{\sqrt{9x^4+8x+10}}{5x^2-2x+1}$ **d)** $\lim_{x\to-5^-} \dfrac{\sqrt{4-x}+7}{3x^2+13x-10}$

Question 14: (*12 pts*) Find y'. **Do not simplify your answers**.

a) $y = 4x^8 - 2\sqrt[3]{x} + \dfrac{3}{\sqrt[5]{x}} + e^{\pi}$ **b)** $\sin(xy^3) = 3e^{5x} + \cos(2y)$

c) $y = \dfrac{\tan(x)(2x^2+5)}{\csc(x^3)}$ **d)** $y = \log_4\Big(\cos(x)\Big) - (4x^3+7x-3)^5$

Question 15: (*3 pts*) Find y', given that $y = \ln\left(\dfrac{(6x-5)^7\ \csc(x)}{(3x+8)^4\ \sqrt[9]{x^2+1}}\right)$ Give a simplified answer. (Hint: Simplify using properties of ln before differentiating.)

Question 16: (*5 pts*) The potential V (in Volts) of a certain electric charge is given by $V = \dfrac{6}{t+1}$, where t represents the time in seconds. Evaluate $\dfrac{d^2V}{dt^2}$ after $t = 2.00$ seconds. (Round appropriately.)

Answers:

1.) 42 **2.)** $-\frac{14}{29}$ **3.)** $(-4, 2, 5)$ **4.)** $F_2 = 55.4\text{N}$, $\theta = 49.0°$

5.) 29.7m, 39.7° and 59.0° **6.) a)** 20m **b)** 12 minutes **c)** $h(t) = -20\cos\left(\frac{\pi}{6}t\right) + 30$

7.) $y = -14x + 21$ **8.) a)** $x = -1$ **b)** $x = \frac{2}{9}$

9.) a) $x = \frac{\pi}{2}$ (1.5708) or $x = 3.8713$ or $x = 5.5535$ **b)** $x = 1.8925$ or $x = 5.0341$

10.) a) $6 + 17j$ **b)** $-\frac{83}{58} - \frac{155}{58}j$ **c)** $-246\,046 + 1\,315\,911j$ **11.) a)** 121V **b)** 93.5V **c)** 135V

d) It lags the current by 26.4° **12.) a)** 1 **b)** 1 **c)** -1 **d)** -1 **e)** 0 **f)** $+\infty$ **g)** DNE

h) -2 **i)** $x = -2,\ 0,\ 1,$ and 3 **13.) a)** $-\frac{4}{9}$ **b)** $-\frac{2}{5}$ **c)** $\frac{3}{5}$ **d)** $+\infty$

14.) a) $32x^7 - \frac{2}{3}x^{-2/3} - \frac{3}{5}x^{-6/5}$ **b)** $\dfrac{15e^{5x} - y^3\cos(xy^3)}{3xy^2\cos(xy^3) + 2\sin(2y)}$

c) $\dfrac{\left(\sec^2(x)(2x^2+5) + \tan(x)\cdot 4x\right)\csc(x^3) - \tan(x)(2x^2+5)\left(-\csc(x^3)\cot(x^3)\cdot 3x^2\right)}{\csc^2(x^3)}$

d) $\dfrac{-\sin(x)}{\cos(x)\ln(4)} - 5\left(4x^3 + 7x - 3\right)^4\left(12x^2 + 7\right)$ **15.)** $\dfrac{42}{6x-5} - \cot(x) - \dfrac{12}{3x+8} - \dfrac{2x}{9(x^2+1)}$

16.) $\dfrac{dV}{dt} = \dfrac{-6}{(t+1)^2}$ $\dfrac{d^2V}{dt^2} = \dfrac{12}{(t+1)^3}$ $V''(2.00) = \dfrac{4}{9} = 0.444\ \text{V/s}^2$