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Q1. A mechanical engineer is creating a design for a new engine. He judges that there will be a 50%, 30% and 20% chance that it will have high eneregy (H), medium energy (M) and low energy (L) consumption. Generally 30% of H engines, 50% M engines and 60% of L engines have been approved, while the rest is being disapproved by the management.

a) What are the two random variables above?

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b) Construct a 2- way frequency table.

Using the <u>frequency table only</u>, find the probabilities of:

c) The design will result in an approved engine. ________________________

d) A randomly selected engine will be a M engine and approved one. _________________

e) A randomly selected engine will be a L engine provided that it is a disapproved one.

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Q2. A random variable X has a cumulative distribution function given by $F(x)$ such that

$$F(x) = \begin{cases} 0 & ,x < 0 \\ mx^n & ,0 \leq x \leq 2 \\ 1 & ,x > 2 \end{cases}.$$

If $E(X) = 2/3$, obtain two equations to find m and n (Not necessary to solve).

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Q3. Solve the differential equation $\frac{dy}{dx} - 3x^2y = 1, y(0) = 0$ representing $y = y(x)$ as an integral.

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Q4. Let $y(x)$ be the solution to the differential equation in Q3. Show that $\lim_{x\to\infty} \frac{y(x)}{e^{x^3}}$ is existing as a converging improper integral**.**

Q5. Two numbers A and B are approximated as C and D, respectively. Show that

$$Rel(C \times D) \approx Rel(C) + Rel(D)$$

$$Rel\left(\frac{C}{D}\right) \approx Rel(C) - Rel(D)$$

If $C = 2.34$, $D = 5.23$ and rounding method use for the approximation, find maximum relative error of $C \times D$ and $\frac{C}{D}$.

Q6. Given $f(x) = -12x^5 - 6x^3 + 10$, apply secant root location technique taking initial guesses as 0.8 and 1 to find a real root of $f(x)$. Perform iterations until absolute relative error goes below 1%.