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අධ්‍යාපන පොදු සහතික පත්‍ර උසස්පෙළ විභාගය - 2023
General Certificate of Education (Adv. Level) Examination, 2023

සංයුක්ත ගණිතය I & II Combined Mathematics I & II	පැය 03 Three hours	අමතර කියවීම් කාලය - මිනිත්තු 10 යි. Addition al Reading time - 10

Use additional reading time to go through the question paper, select the questions you will answer and decide which of them you will priorities.

ඇ
Name of the candidate's

Instructions:

- This question paper consists of two parts ;
  Part A (Question 1 - 10) and **Part B** (Question 11 - 17)

Part A

- Answer all questions. Write your answers to each question in the space provided. you may use additional sheets if more space is needed.

Part B

- Answer 5 questions only. Write you answers on the sheets provided.
- At the end of the time allotted, tie the answer scripts of the two parts together so that Part A is on top of Part B and hand over the supervisor.
- You are permitted to remove only Part B of the question paper from the examination Hall.

Combined Maths - 10-S-I & II

Part	Question No	Marks
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	

Combined Maths -10-S- I & II

Part B	Question No	Marks
	11	
	12	
	13	
	14	
	15	
	16	
	17	

Final Marks

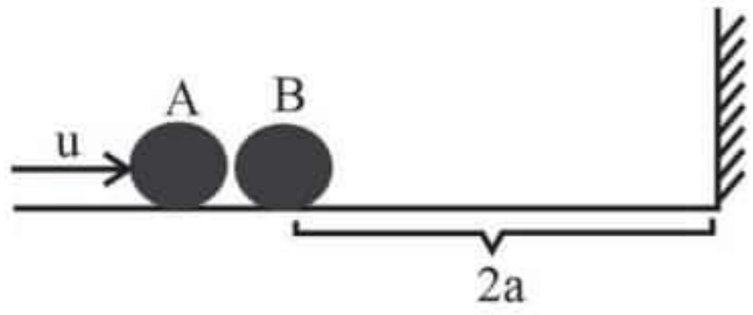
In Number	
In words	

3rd Term Test - 2022 November - Grade - 13

Part - A

- **Answer All Questions**

01. Two small spheres A & B each of mass m placed on a horizontal table, sphere A moves with u velocity and strikes simply with sphere B which is at rest, find the velocities of A and B after first collision. Then when B collides with the smooth vertical wall, sphere A is at "a" distance from the wall, find the coefficient of restitution between the two spheres.



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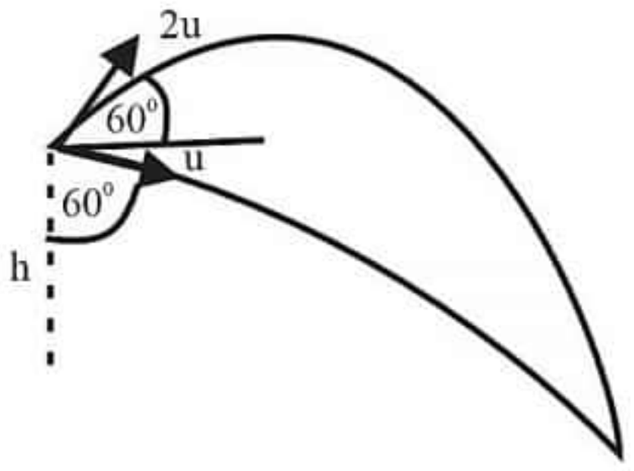
02. Particle A projected from a point making 60^o angle with the horizontal with 2u velocity after t time A projected, another particle B projected from the same point making 60^o angle with the downward vertical with u velocity. If A and B collided at h height down from the point of projection, after 2t time from the first projection, find t.



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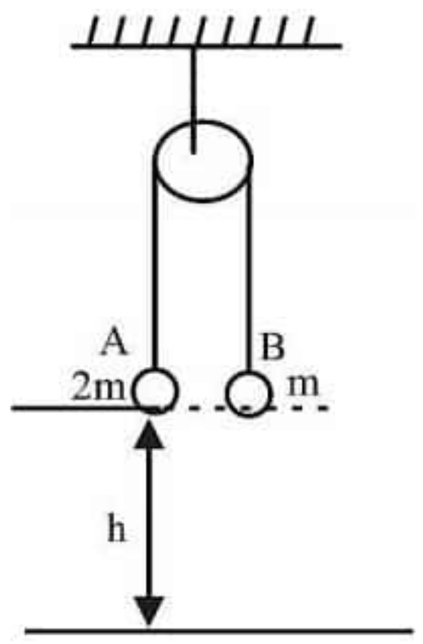
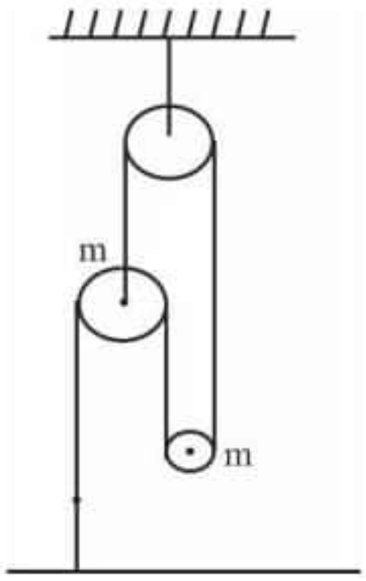
03. The figure shows two particles A and B of masses 2m and m respectively, such that A placed on a smooth table and B hangs freely on the same level of A. An impulse I given to B so that when it comes to the ground its velocity becomes zero. Show that

I = m $\sqrt{12g}$



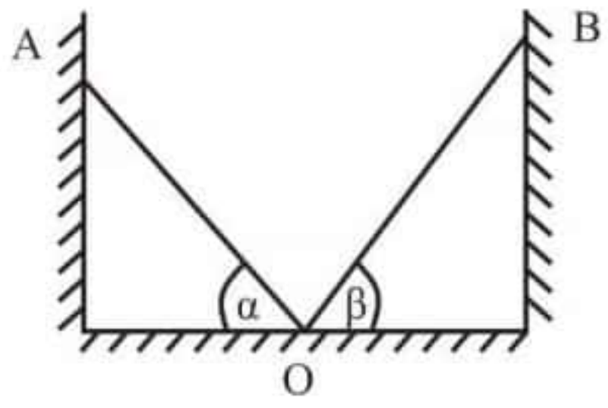
04. The diagram shows a system of pulleys consist with two movable pulleys with mass m and one fixed pulley, find the tension of the string.



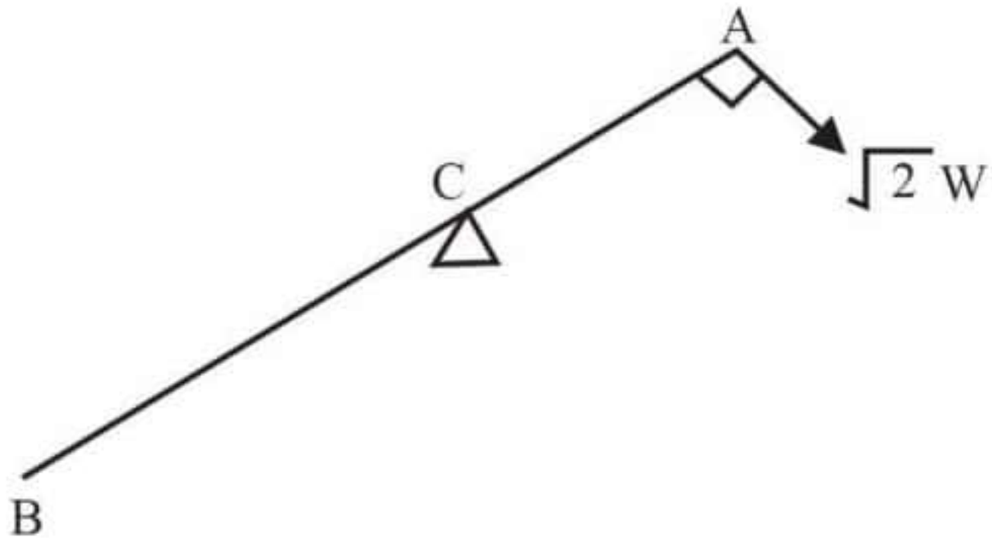
05.A motor car of mass 1500 kg moves along a horizontal path releasing it's maximum power against 60N resistance and gained 150 kmh^{-1} maximum velocity. Find the acceleration of the motor car when it is moving along the same path against the same resistance with it's maximum power and the speed is $60kmh^{-1}$.

06. By usual notation position vectors of the points A and B with respect to O fixed point is $2i + 3j$ and $-2\underline{i} + 4\underline{j}$ If AB cuts the Y axis at C, find the position vector of point C.

07.AO and BO are two uniform rods kept in equilibrium touching two parallel smooth vertical walls at A & B and also touching each other at O on a smooth horizontal plane. Inclinations of both rods AO and OB to the horizontal be $\propto$ and β. The weights of OA and OB are W_1 and W_2. Show that $W_1 \cot \propto = W_2 \operatorname{Cot} \beta$



08.A uniform rod AB of weight 2W, and length 2a is placed in equilibrium on a rough peg C, such that A is positioned above B as shown in the figure applying $\sqrt{2}W$ force at A . Find the inclination of the rod with the horizontal. If AB:CB – 1:3. When the rod is in the limiting equilibrium position, show that the coefficient of friction between the rod and the peg is $\frac{1}{2}$.



09.A and B are two events in the sample space Ω It is given that $P(A) = \frac{3}{5}$, $P(B/A) = \frac{1}{4}$ and $P(AUB) = \frac{4}{5}$ find P(B), show that A and B are not an independent events.

10. x_1, x_2, x_3, x_4 and x_5 are five numbers. The lowest number is 1 and the median is 6. Median is not equal to mode and mean is 5. Find these numbers.

Sirimavo Bandaranaike Vidyalaya - Colombo - 07

Combined Mathematics -II

GCE (Advanced Level) Examination 2022

3rd Term Test - 2022 November - Grade - 13

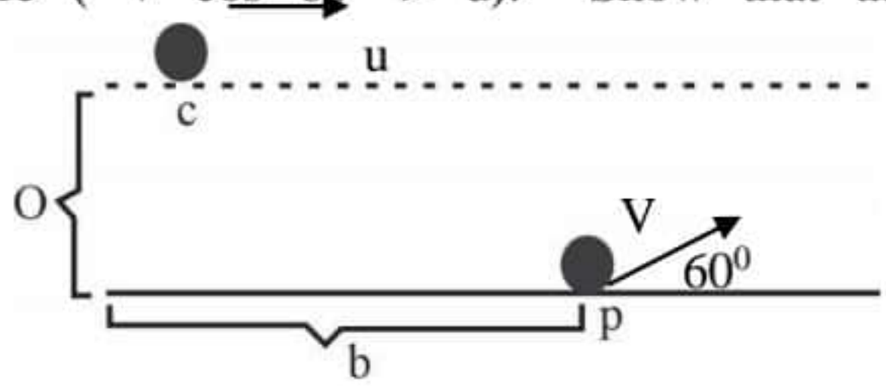
Part - B

- **Answer 5 questions**

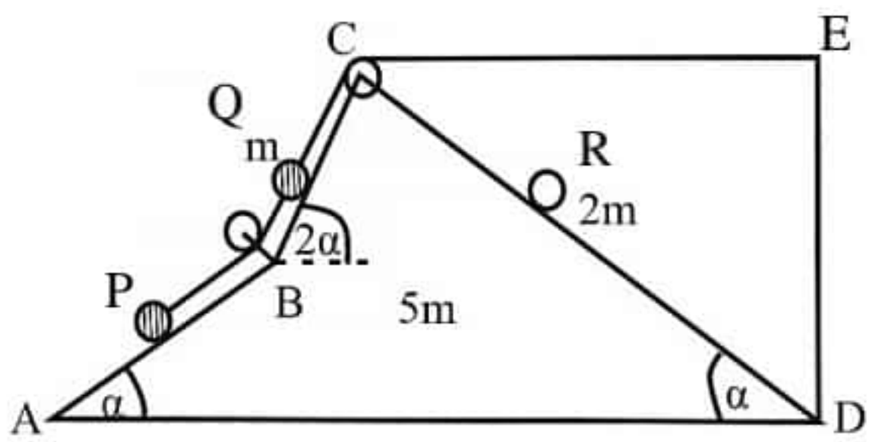
11. a) A. particle is projected vertically upwards with u velocity and after t time another particle is projected with same velocity from the same point vertically upwards. Draw velocity time graph for the motion of first particle relative to the second particle. Hence show that two particles meet each other after $\frac{t}{2}+\frac{u}{g}$ time after the first particle projected.

b). The length from the edge of the pavement of a straight road to a straight line L parallel to the road is a. A motorbike C travels with u velocity along L line. At time t= 0, a man P starts to cross the road with V velocity making 60^O with the road at a point A on the pavement, distance b ahead of O, which is the position of the bicycle at t = 0. If the man cross the road infront of the bicycle, find the velocity of the man P, relative to motorcycle C. Where (V cos 60^0 > u). Show that the shortest distance between C and P is $\frac{v(a+\sqrt{3}b)-2au}{2\sqrt{u^2+v^2-uv}}$

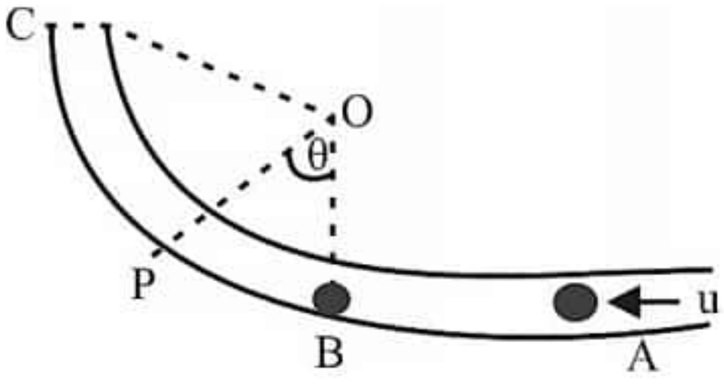
Hence show that the man P can cross $v > \frac{2au}{a+b\sqrt{3}}$



12. a) The figure shows ABCD smooth wedge of mass 5m with smooth inclined faces AB, BC and CD α, 2 α, and α inclinations with the horizontal. Two particles P and Q each of mass m, connected by an inextensible string, which passes below a fixed smooth pulley at B and over a smooth pulley at C and connected to a vertical wall at E, keeping the string parallel to the horizontal. Another particle R of mass 2m is placed on the CD plane and all released at rest simultaneously. Write enough equations to determine the acceleration of the wedge.



b). Figure shows to smooth pipes with same cross section consist with AB pipe is straight and CB circular pipe with radius a subtending an angle $\frac{2\pi}{3}$ at the centre O. This system fixed in the vertical plane according to the figure. A particle of mass m is placed inside the pipe at A and a particle of 2m is placed at point B, and given horizontal velocity u. Then two particles collided each other and coalesce together.



i) Find the velocity of the composite particle after the collision.

ii) If V is the velocity of the composite particle at a point P when OP making θ angle with the down word vertical show that, $v^2 = \frac{u^2}{9} - 2ga(1 - cos\theta)$

iii) If R is the reaction from pipe on the particle, show that
$R = \frac{3m}{a}[\frac{u^2}{9} - 2ga + 3gacos\theta]$

iv) If AB = $\sqrt{3}a$ and the composite particle leaves the pipe form the end C end landed at point A, show that u = $\frac{3\sqrt{21ag}}{2}$

13. A particle of mass m is connected to the mid point of an extensible string AB of natural length a, end A fixed to a point and B fixed to a point vertically downward 2a distance from A. When the system is in equilibrium the particle is at $\frac{5a}{4}$ distance from A. find the modules of elasticity of the string.

In the equilibrium position a velocity of $\sqrt{ag}$ is given to the particle, show that the motion is in simple harmonic and find the time taken to slack the lower part of the string using $x = \frac{a}{4} + A_1\, cosw_1t + B_1 sinw_1t$ where x is the extension of the string. After the lower part of the string becomes slack by taking the extended distance from there as y, using the result $y + {}^{a}/_{2} = A_2 \cos w_2t + B_2 \sin w_2t$ find the time taken by the particle becomes to instantaneous rest.

14. a). ABC is a triangle, position vectors of the points A, B, C, with respect to a fixed point O, are $\underline{a}$, $\underline{b}$,$\underline{c}$ and respectively. D and E are two fixed points on AC and BC such that AD:DC = 1:4, and BE:EC=3:2. F is the intersection point of BD and AE.

i) If AF : FE = 1 :λ show that $\overrightarrow{AF} = \frac{1}{5(1+\lambda)}(2b - 5a + 3c)$

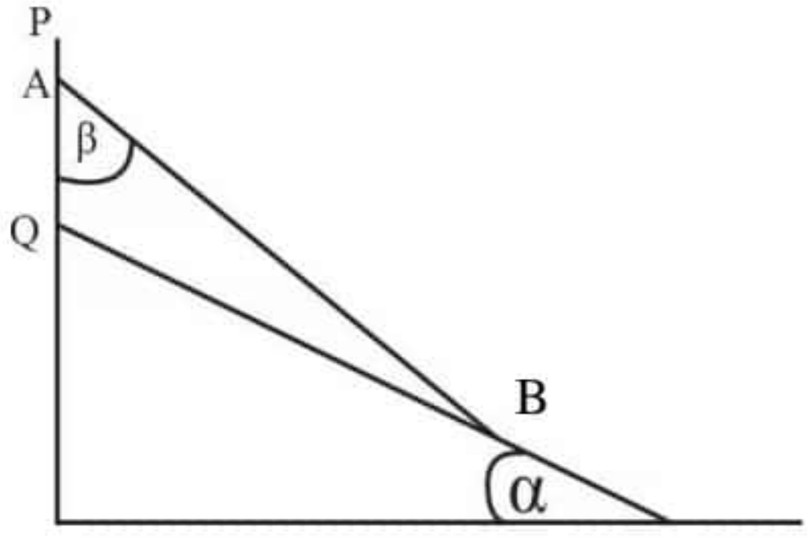
ii) BF : FD = μ : 1 $\overrightarrow{AF} = \frac{1}{5(1+\lambda)}\{5b - (5 + \mu)a + \mu c\}$ Hence, find λ and μ.

b). ABCDE is a trapezium with AC and ED sides are horizontal, B positioned on AC so that AB = 2a and BC=a and DE=2a CD=$\sqrt{3}a$ A system of forces with magnitudes 3F, F, F, 3F, 2F, 7F and $\sqrt{3}$F act along the sides AB, BC, AE,BE, BD, DE and CD. Find the resultant of the system.

(i). When the system reduced to two forces P and Q passing along CE and CA find the values of P and Q.

(ii). If a force X and a couple G act as the resultant of the system act through C, find X and G values.

15. a) The diagram shows a uniform rod of weight 2W AB is placed is equilibrim touching cud A again -81 PQ smooth vertical wall and end B or a rough inclined plane of inclination α to the horizontal. Rod is in equilibrium in the vertical plane making β angle with the vertical wall where tan $\beta = \frac{5}{12}$



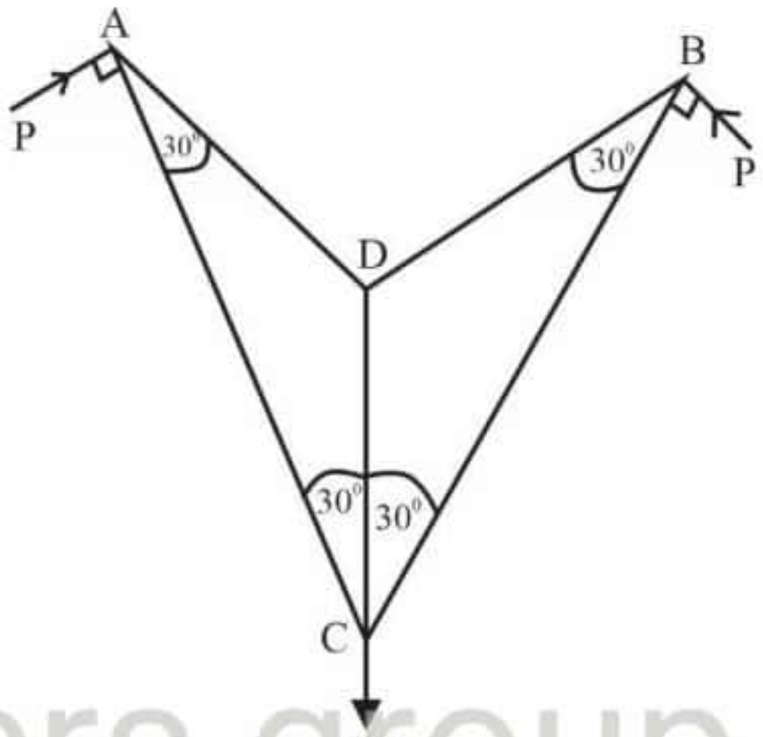
i) Show that the reaction on the rod from the wall is ${}^{5w}/_{24}$

ii) find the normal reaction on the road and the frictional force at end B

b) The figures shows a light frame work consisting with five light rods smoothly joined at their ends AD=DC=DB and also AC=BC further $D\hat{A}C = D\hat{C}A = D\hat{B}C = 30^0$ At vertices B and A applied two equal forces perpendicular to CB and CA, also carries a load of 5N at C. So that the system is kept in equilibrium in the vertical plane.

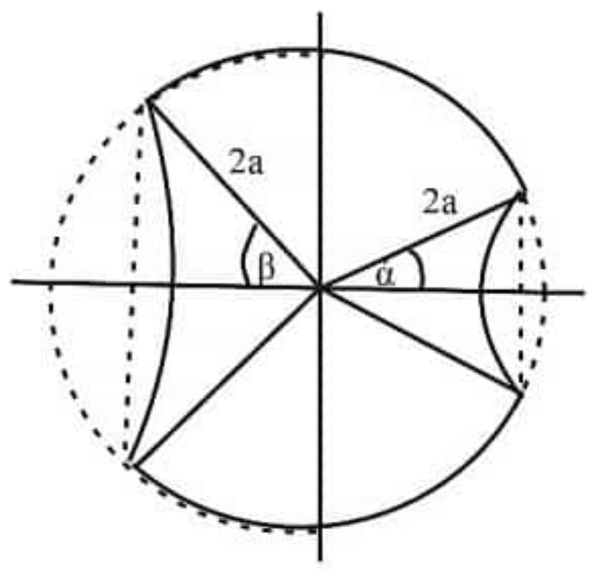
(i). Find the value of P

(ii). Using bows notification, find all stresses of the rods indicating them as tension or thrusts.



16. i) Show by integration the position of the centre of gravity of hemispherical circular are of radius a is at $\frac{2a}{\pi}$ on its as axis.

(ii). As shown in the figure out of a uniform spherical shell of radius a zone is cut off by two parallel planes at distance $2acos\alpha, 2acos\beta$ from the vertical diameter across its centre where $\alpha > \beta$ Show by integration



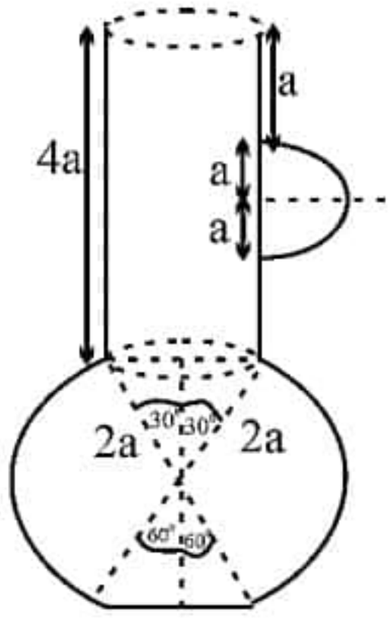
(16.1 රූපය)

(a). The surface area of the remaining body

(b). The position of the centre of gravity.

From this body above formed, taking $\alpha = 30^0$ and $\beta = 60^0$ there fixing a hollow cylinder of radius a height 4a to the hole of radius a and made a goglet. Also a thin semi circular wire of radius a fixed to the cylinder and a circular plate with radius $\sqrt{3}$a with same material fixed to the bottom as shown in the figure. Find the centre of gravity of this goglet with respect to the vertical and horizontal axes through the centre of the initial spherical zone.

Take 2σ and σ are the mass of unit area and unit length of the material sheet and the metal wire respectively.



17. a) In a certain company, 2/3 of the employees are women and 75% of these prefer to do shopping while 30% of the male employees prefer to do the same. Find the probability of preference for do shopping when choosing an employee from this company randomly. If this chosen employee does not like to do shopping,

(i). Find the probability that the chosen employee be a women .
(ii). And be a man

Are these two events which the preference to do shopping and be a women independent from each other? Explain your answer.

b). Length of 32 leaves of a certain tree are measured and tabulated as follows to the nearest millimeter.

Length	**20-22**	**23-25**	**26-28**	**29-31**	**32-34**
Frequency	3	6	12	9	2

Find the median of the distribution

Using the coding method $u_i = \frac{x_i - 27}{3}$ find the mean and the standard deviation of the distribution.

Where x_i is the mid value of the respective class interval.
Also find the coefficient of skewness of this distribution, hence determine the shape of the distribution.

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