JOINT END OF YEAR EXAMS, 2025
SENIOR FIVE APPLIED MATHEMATICS
2HOURS 30 MINUTES

Instructions

Section A is compulsory
Attempt any three (3) items from section B
In numerical work, take g to be $\mathbf{9.8\ ms^{-2}}$.

SECTION A
Attempt all questions from this section

Item 1

The daily incomes, rounded to the nearest pound, of households on a certain street are given below:

22 24 25 25 26 27 26 27 29 29 37

Calculate the mean and standard deviation for these daily incomes.

Item 2

A candy shop is having a lucky draw to advertise its business. On average ,40% of the candy bars produced contain a lucky draw ticket each. The shop owner orders for n candy bars on a particular day, and it is known that the number of candy bars follows a binomial distribution whose variance is 1.92.

Help the shop owner to

(i) Determine the number n of the candy bars that she ordered.
(ii) Determine the chance of drawing more than 3 lucky tickets.

Item 3

In a square ABCD, three forces of magnitude 5N ,10N, and $8\sqrt{2}$ N act along the lines AB, BC and AC respectively in the direction indicated by the order of the letters. Find the magnitude of the resultant force.

Item 4

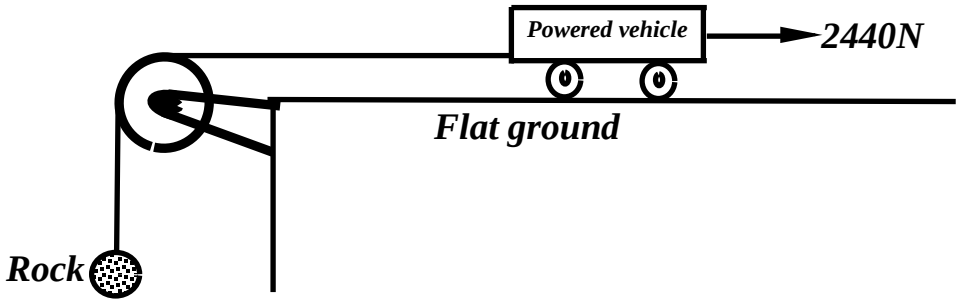
Three dealers, Anne, Bill and Carl supply antiques to an auction house. Anne supplies 45% of the antiques, Bill supplies 38% and the remaining antiques are supplied by Carl. Past records indicate that 5% of the antiques supplied by Anne are fake. The percentages of antiques supplied by Bill and Carl which are fake are 7% and 3% respectively.

James buys an antique from the auction. Find the probability that the antique is fake.

Item 5

In a quarry a heavy stone is lifted up from the bottom of a cliff to an area where they can be easily loaded onto Sino truck vehicles. The rock to be lifted is tied to one end of a wire cable which passes over a small smooth pulley which is fixed at the edge of a smooth flat ground to a powered vehicle of mass 120kg whose engine produces a

constant forward force of **2440N**.When the powered vehicle accelerates from rest at $\frac{1}{60}\ ms^{-2}$ to the right, the rock is lifted.



Calculate the mass of the rock.

Item 6

Bag X contains 4 red and 3 blue pens, while **Bag Y** contains 3 red and 2 blue pens. A bag is selected at random and two pens are drawn from it without replacement. Find the probability of picking pens of different colours.

Item 7

Forces of 7N and 4N act away from a common point and make an angle θ with each other. Given that the magnitude of their resultant is 10.75N, find the value of θ direction of the resultant.

Item 8

A particle passes through the point *A* with speed ***25.2kmh*** $^{-1}$, moving along a straight horizontal path with constant acceleration. The particle passes through the point *B,* where ***AB* = 56.8 m**, 4 s after passing through *A* . Determine the speed of the particle as it passes through *B.*

SECTION B

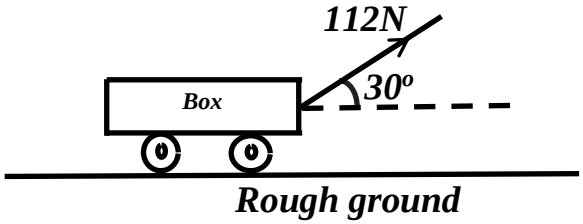
Attempt any three (3) items from this section

Item 9

Juma is to move from their house to a highway where the taxi is waiting for him.

He will use a straight horizontal rough road that is ***100m*** long, connecting their house to the highway. The surface of this road has a coefficient of friction 0.05.

As he moves to the highway, he pulls a box ***30kg*** initially at rest along the rough road, using a constant force of magnitude **112N** that is inclined at 30° to the ground as shown the figure below.



The taxi will only wait for Juma if the time he takes from the start of his journey from their house up to the highway does not go beyond **1 minute.**

Task

Help Juma to determine

(i) the acceleration of the box

(ii) whether he will find taxi driver still waiting for him.

Item 10

A farmer has plans of fencing off his rectangular plot of land which measures 16.25m in length and 12.5m wide both measured to the nearest units. The estimated cost per meter of wire to be used in fencing is Shs. 5000 with a margin of error of 5%

Task;

(a) Help the farmer to estimate the interval within which the total length of wire to be used lies.

(b) Help the farmer to find the interval within which the total cost of fencing the plot is expected to lie.

Item 11

A shopping mall has three automated teller machines (ATMs) which are frequently used making them to sometimes stop working and need to be repaired. When the mall opens on a selected day the number of machines that are working is denoted by the random variable X whose probability distribution is given in the table below.

Number of machines working, x	0	1	2	3
Probability, $P(X = x)$	0.15	0.21	0.40	0.24

Two shoppers Musa and Jane wanted to withdraw some money from one of the machines. Musa will withdraw money from one of the machines if the **expected value**, of the number of ATM machines that are working on that day, is more than 3.

Jane will only withdraw money from one of the machines if the probability that at least 2 machines are working is more than 0.5

A restaurant owner in this shopping mall wishes to know how many customers she can serve when the midday temperature is 28 ^{0}C. To achieve her objective, she collected data shown in table below.

Mid-day temperature (^{o}C)	17	20	25	29	27	21	20	24
Number of customers	40	42	42	43	44	39	41	45

Task: As a mathematician, help the

(a) two shoppers Musa and Jane to know if they are to withdraw money from the ATM.

(b) restaurant owner to determine the number of customers she should expect on a particular day when the mid-day temperature is 28 ºC.

Item 12

John plays for his school's soccer team. There is a probability of 0.15 that he scores in a game and a probability of 0.3 that his parents are present at any game. Given that he scores in a game, there is a probability of 0.2 that his parents are present.

In John's school the mathematics teacher gave a test to John and his classmates and the following marks were recorded.

Marks	35−40	40−60	60−65	65−70	70−90
Frequency	5	4	3	8	10

The teacher promised the entire class a dance party if the mean of the whole class is at least 60 marks

Task :

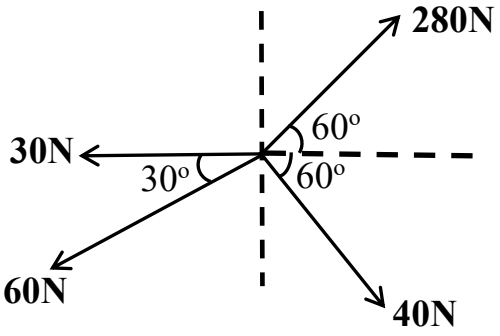
(a) (i) Show that the probability that John scores in a game given that his parents are present is 0.1

(ii) Will John's parent's presence at a game affect his chances of scoring in a game? Justify your answer.

(b) By showing your working, will John and his classmates be given a dance party.

Item 13

A stone rolled down the hills, stopped and blocking a road. This paralyzed the movement of vehicles. Four villagers tied ropes and pulled the stone as shown in the figure below.



At the roadside where the stone stopped, there was a solar lamp of mass 1kg which hangs in equilibrium from a horizontal support by means of two chains attached to the lamp. The chains make angles of 20^o and 60^o with the horizontal.

Task:

(a) Will the forces applied on the stone as shown in the figure move the stone? If yes determine the direction in which the stone will move.

(b) Find the tension in the chains holding the lamp.

END