CMoS

S.5 MATHEMATICS- 2025

GROUP ASSIGNMENT M002

GROUP NAME: ....STREAM: ....

GROUP CHAIRPERSON: ....EXPECTED SCORE:............

ITEM 1: NUMERICAL CONCEPTS 🧱.

☀ To study the performance of a specialized solar panel, its brightness **Y**, measured at time, **t** hours after sunrise, is modeled by the formula:

$$Y = 3\left(\frac{\sqrt{32t}}{4^t}\right)$$

🔍 **Task**:

(a) Simplify the expression for the brightness. Your final answer should express the brightness using a **single power of 2** and a **surd**.

(b) At a moment when the brightness is observed to be *3.0 arbitrary units*, **prove** that the equation:

$$\log_t 2 = \frac{1}{4t - 5}$$

is satisfied.

(c) Hence, or otherwise, determine the value of $\log_2 \sqrt{8t}$ at *that same time*.

(12 scores)

ITEM 2: TRIGONOMETRY ⚠.

🧑 An architect is testing the strength of an inclined **support beam** that forms an angle, x with the horizontal base of a newly designed bridge.

To assess two critical design measures:

🔺 Vertical force efficiency (denoted by m) is calculated as:

$$m = tanx + sinx$$

🔻 Horizontal load balance (denoted by n) is calculated as:

$$n = tanx - sinx$$

These expressions come from force projections and decompositions acting at the angle of inclination, x.

For safety and structural approval, the engineers must verify that the design satisfies the condition:

$$mn = \left(\frac{m^2 - n^2}{4}\right)^2$$

✍ **Task**:

As a student of trigonometry, help the engineers satisfy the condition so as to verify the design and approve their structure.

(12 scores)

ITEM 3: <u>EQUATIONS AND INEQUALITIES</u> 📈.

📱 A technology company has released a new mobile application. The number of downloads (in thousands), denoted by D, changes each week and is modeled as a function of time, n where n is the *number of weeks* since launch:

$$D(n) = -4n^2 + 28n - 40$$

Let the values of n that *satisfy* the equation $D(n) = 0$ be r and s.

❓ **Task**:

    (a) State what the values r and s represent in the context of the app's downloads.

    (b) Find the solution set of r and s.

    (c) Determine the week in which the app reaches its **highest** number of downloads.

    (d) Calculate the **maximum** number of downloads, and explain how it connects to your results in part (a).

(12 scores)

ITEM 4: <u>DESCRIPTIVE STATISTICS</u> 📊.

　　　📈 As part of a performance review, a logistics company organized a practical assessment for a group of *180* trainee dispatchers. The aim was to evaluate their speed and accuracy in handling simulated delivery assignments. Their scores out of 100 were compiled and grouped as shown below:

Marks	<20	<26	<35	<45	<55	<60	<68	<80	<95
Cumulative number of learners	0	6	24	66	110	130	154	174	180

Two additional policies were announced during the assessment:

- 🎖️ Any dispatcher scoring **75 or above** would qualify for a **performance bonus**.

- 📘 Those who scored **below the average** would be enrolled in a **refresher training program**.

　　　Further guidelines included:

- 🏆 Only **20 dispatchers** were to receive a "top performer" recognition.

- 📈 If the measure of spread in scores (standard deviation) exceeded **10 marks from the mean**, the assessment would be flagged as **inconsistent**.

🧠 *Task*:

　(a) Assist the operations manager in determining:

　　　(i)　　　How many dispatchers will receive the performance bonus.
　　　(ii)　　 How many must attend the refresher training.
　　　(iii)　　The **minimum score** required to be among the top 20 performers.

　(b) Based on the scores, would you consider the performance results consistent?

(12 scores)

ITEM 5: <u>DYNAMICS I- RESULTANT & COMPONENTS OF A FORCE</u> ⚙️.

　　　🛏️As part of a training exercise for emergency response engineers, a test was conducted using a *steel rescue stretcher* suspended in mid-air by *six tension cables*.

　　　Each cable pulled the stretcher with a different force and direction:

- *Two upward* vertical pulls of 8 N and 16 N

- *One downward* pull of 20 N

- *Two horizontal* pulls to the *left* with magnitudes 9 N and 7 N

- *One horizontal* pull to the *right* with a magnitude of 18 N

Your task is to determine the **resultant force** acting on the stretcher and the **net effect** this would have on its motion.

In a separate simulation, engineers modeled a **supply drone** attached *to five directional anchors via tethers*. Each anchor pulls with the following magnitudes and directions:

- 50 N at *45°*

- 80 N at *135°*

- 90 N at *210°*

- 70 N at *300°*

- 30 N at *15°*

Based on this model, determine the **single equivalent force** acting on the drone and the **direction it would move** under the influence of these forces.

✏️ **Task**:

As a student of applied mechanics, carry out calculations to solve each of the two cases above, determining both the **magnitude** and **direction** of the resultant forces involved.

(12 scores)

Yours Academically,

CMoS Assignments,

Set By PaulTutor.

HardWork-In, Luck-Out ✅

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