Name:_____

$I\ D$ $N\ O$	:								0 1 8 *am*	0 2 9 *am*	0 3 10 *am*	
Time 120*Min*	*Seat No.* :				*Marks* 100	*Marks Secured* :			*c o d e*	*T h r e*	0 3 e 3	

NOTE: 1. The questions are not in any order of difficulty at all.

2. All questions carry equal number of marks.

3. Only the nonprogramable calculators are allowed.

4. All types of PAGERS, OR MOBILES ARE NOT ALLOWED to be with you during the examination.

5. Use an HB 2 pencil.

6. Use a good eraser. Do not use the eraser attached to the pencil.

7. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.

8. When bubbling your ID number and Section number, be sure that bubbles match with the number that you write.

9. The test Code Number is already typed and bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.

10. When bubbling, make sure that the bubbled space is fully covered.

11. When erasing a bubble, make sure that you do not leave any trace of penciling.

12. Count that the exam has TWENTY Questions and EIGHT Pages.

13. Please BUBBLE carefully only right answer letter (A or B or C or D or E) corresponding to the correct answer to each question in the enclosed computerized Omar Sheet, with pencil only.

14. Please do not leave any question unbubbled in the Answer Sheet.

15. Please check that the version of your question paper and the answer sheet enclosed with it matches correctly. The versions are 001, 002, 003, 004.

Compound Interest Formulae: $S = P(1+r)^n$, $P = A(1+r)^{-n}$. Effective Interest Formula: $r_e = \left(1+\frac{r}{n}\right)^n - 1$.

Continuos Interest Formula: Present $P = Ae^{-rt}$, Effective Interest Formula: $r_e = e^r - 1$.

Ordinary Annuity Formulae (End): Future Value $= S = R.\left[\frac{(1+r)^n - 1}{r}\right]$.

Present Value: $A = R.\left[\frac{1-(1+r)^{-n}}{r}\right]$.

Annuity Due Formulae (Beginning): Future Value $= S = R.\left[\frac{(1+r)^{n+1} - 1}{r} - 1\right]$.

Present Value $= A = R.\left[1 + \frac{1-(1+r)^{-n+1}}{r}\right]$.

${}^nP_r = \frac{n!}{(n-r)!}$; $\binom{n}{r} = {}^nC_r = \frac{n!}{r!\,(n-r)!}$.

$\#(A \cup B) = \#(A) + \#(B) - \#(A \cap B)$

Pr*obability* Laws: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

Conditional Probability: $P(A/B) = \frac{P(A \cap B)}{P(B)}$.

Events A and B are Independent $\iff P(A \cap B) = P(A)\,P(B) \iff P(A/B) = P(A) \iff P(B/A) = P(B)$.

BINOMIAL DISTRIBUTION: $P(X = x) = \binom{n}{x} p^x q^{n-x}$; $x = 0, 1, 2, 3, 4, \ldots, n$; $q = 1 - p$.
Mean $= \mu = np$; $Var(X) = \sigma^2 = npq$.

1Q.1. TB2.3.4.MC70. A company will manufacture a total of 5000 units of its product at plants A and B.

At plant A the unit cost for labor and material combined is \$ 2.50, while at plant B it is \$ 3.00.

The fixed costs at plant A are \$ 6000 and at plant B they are \$ 8000.

Between the two plants the company has decided to allot no more than \$ 28000 for total costs.

The minimum of units that must be produced at plant A is

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	2546	
$B \longrightarrow$	2000	
$C \longrightarrow$	2500	
$D \longrightarrow$	2545	
$E \longrightarrow$	1871	

2Q.2.TB4.2.19. MC134. Suppose that a manufacturer will place on the market 80 units of a product when the price is \$ 10 per unit, and 100 units when the price is \$ 12 per unit.

Find the supply equation for the product assuming that price p quantity q are linearly related.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	$p = \frac{1}{10}q + 2$	
$B \longrightarrow$	$p = \frac{1}{10}q + 10$	
$C \longrightarrow$	$p = -\frac{1}{10}q + 12$	
$D \longrightarrow$	$p = 10q + 12$	
$E \longrightarrow$	$p = 10q - 988$	

3Q.3. TB8.3.6MC250. Suppose an annuity due consists of 6 yearly payments of \$ 200 and the interest rate is 5 % compounded annually.

Determine the future value at the end of 6 years.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	\$ 1350.65	
$B \longrightarrow$	\$ 1286.00	
$C \longrightarrow$	\$ 1380.50	
$D \longrightarrow$	\$ 1428.40	
$E \longrightarrow$	\$ 1585.78	

4Q.4. TB9.5.11MC274. After a production run, it was found that 10 % of the units produced had a faulty weld and 5 % had both a defective paint job and a faulty weld.

If a unit is randomly selected from this run and it has a faulty weld, what is the probability that it also has a defective paint job?

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	0.05	
$B \longrightarrow$	0.50	
$C \longrightarrow$	0.10	
$D \longrightarrow$	0.20	
$E \longrightarrow$	0.30	

5Q.5. Rolf163TB32. A box contains 8 light bulbs, two of which do not work.

If two bulbs are selected, the probability of selecting both bulbs that do not work is

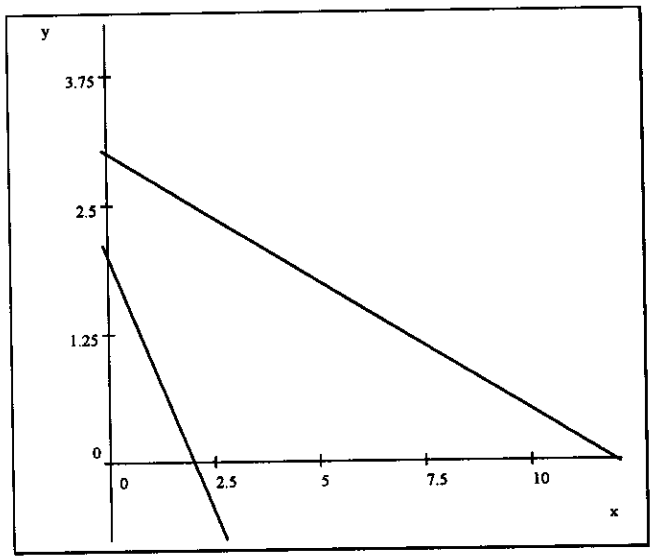
Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	$\frac{1}{4}$	
$B \longrightarrow$	$\frac{3}{4}$	
$C \longrightarrow$	$\frac{11}{28}$	
$D \longrightarrow$	$\frac{1}{28}$	
$E \longrightarrow$	$\frac{15}{28}$	

6Q.6. 308TB11.3.11. If money earns interest at an annual rate of 8 % compounded continuously, then the present value (in dollars) of \$ 10000 due at the end of five years is

Letter Choice	Possible Answer	($\surd$)
$A \longrightarrow$	$10000e^{-0.4}$	
$B \longrightarrow$	$10000e^{0.4}$	
$C \longrightarrow$	$\frac{e^{0.4}}{10000}$	
$D \longrightarrow$	$10000\,(1.08)^5$	
$E \longrightarrow$	$10000\,(1.08)^{-5}$	

7Q.7. SM148E4. Complete the graph and shade the feasible region of the following system of inequalities and find all the corner points.

$$\begin{cases} x + 4y \leq 12 & (1) \\ x \leq 8 & (2) \\ x + y \geq 2 & (3) \\ x \geq 0 & (4) \\ y \geq 0 & (5) \end{cases}$$



Let M be the maximum value and m be the minimum value of the function

$$Z = x + 5y$$

at the corner points of the feasible region. Find the values of M and m.

Them the sum of the two numbers M and m is given by:

$M + m =$

Letter Choice	Possible Answer	$(\surd)$
$A \longrightarrow$	19	
$B \longrightarrow$	17	
$C \longrightarrow$	15	
$D \longrightarrow$	13	
$E \longrightarrow$	21	

8Q.8. $TB9.2.20MC262$. A student must select two courses in the liberal arts and three courses in the social sciences.

There are six liberal arts courses and ten social science courses, all of which are different, from which the student may choose.

How many selections are possible?

Letter Choice	Possible Answer	Check$(\surd)$
$A \longrightarrow$	900	
$B \longrightarrow$	135	
$C \longrightarrow$	750	
$D \longrightarrow$	1800	
$E \longrightarrow$	21600	

9Q.9. BB153M59. A mattress company produces three styles of mattresses.

Each deluxe mattress contains 50 springs, 12 pounds of padding, and 10 yards of material.

Each regular mattress contains 40 springs, 10 pounds of padding, and 10 yards of material.

Each economy mattress contains 35 springs, 9 pounds of padding, and 10 yards of material.

The company has in inventory 105000 springs, 26100 pounds of padding, and 25500 yards of material.

Let $d = \#$ deluxe mattresses, let $r = \#$ regular mattresses, and let $e = \#$ economy mattresses.

Set up the system of equations (without solution) to find the number of mattresses of each type should the company produce if it wants to delete its inventory?

$$(A).\begin{cases} 50d + 12r + 10e = 105000 \\ 40d + 10r + 10e = 25500 \\ 35d + 9r + 10e = 26100 \end{cases}$$

$$(B).\begin{cases} 50d + 12r + 10e = 105000 \\ 40d + 10r + 10e = 26100 \\ 35d + 9r + 10e = 25500 \end{cases}$$

$$(C).\begin{cases} 50d + 40r + 35e = 26100 \\ 12d + 10r + 9e = 25500 \\ 10d + 10r + 10e = 105000 \end{cases}$$

$$(D).\begin{cases} 50d + 40r + 35e = 105000 \\ 12d + 10r + 9e = 26100 \\ 10d + 10r + 10e = 25500 \end{cases}$$

$$(E).\begin{cases} 40d + 50r + 35e = 105000 \\ 10d + 12r + 9e = 26100 \\ 10d + 10r + 10e = 25500 \end{cases}$$

10Q.10. BB375M29. A man has three suits, each of a different color, and three ties, one matched to each suit.

Without looking, the man quickly grabs one suit and one tie.

What is the probability that the suit and tie match?

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	$\frac{2}{3}$	
$B \longrightarrow$	$\frac{1}{9}$	
$C \longrightarrow$	$\frac{1}{3}$	
$D \longrightarrow$	$\frac{1}{6}$	
$E \longrightarrow$	$\frac{1}{2}$	

11Q.11. 10Rolf86TB. The supply equation is

$p = 28x + 2025$

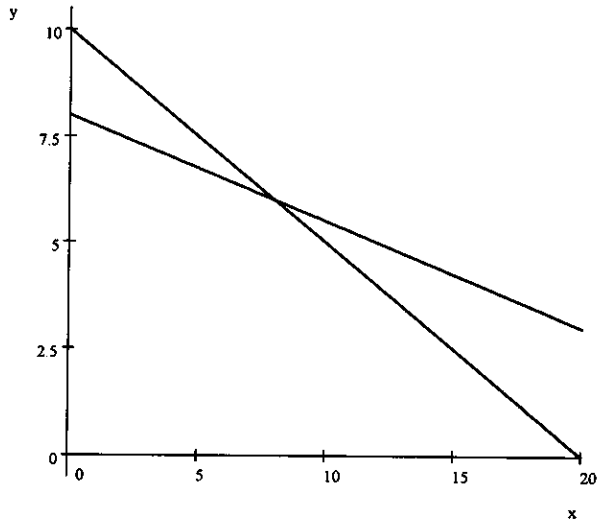
and the demand equation is

$p = -17x + 6120.$

The equilibrium demand x is:

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	45	
$B \longrightarrow$	4573	
$C \longrightarrow$	2025	
$D \longrightarrow$	91	
$E \longrightarrow$	135	

12Q.12. 54Rolf17. For $\begin{cases} x + 2y \leq 20 \\ x + 4y \leq 32 \\ x \geq 0 \\ y \geq 0 \end{cases}$



A point that is NOT a corner point of the feasible region is

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	$(0, 0)$	
$B \longrightarrow$	$(8, 6)$	
$C \longrightarrow$	$(0, 10)$	
$D \longrightarrow$	$(0, 8)$	
$E \longrightarrow$	$(20, 0)$	

13Q.13. 66Rolf82TB. Set up the objective function and constraints for the following problem. Do not solve.

A tailor has 80 yards of cotton material and 120 yards of woolen material. A suit requires two yards of cotton and one yard of wool. A dress requires one yard of cotton and three yards of wool.

How many of each garment should the tailor make to maximize his income if a suit and a dress each sell for \$ 20. What is the maximum income?

Let $x = \#suits$ and let $y = \#dresses.$

$(A).$

Maximize	$Z = 20x + 20y$
Constraints	$x + 2y \leq 80$ $3x + y \leq 120$ $x \geq 0,\ y \geq 0$

$(B).$

Maximize	$Z = 20x + 20y$
Constraints	$2x + y \geq 80$ $x + 3y \geq 120$ $x \geq 0,\ y \geq 0$

$(C).$

Maximize	$Z = 20x + 20y$
Constraints	$2x + 3y \leq 80$ $x + y \leq 120$ $x \geq 0,\ y \geq 0$

$(D).$

Maximize	$Z = 80x + 120y$
Constraints	$2x + y \geq 120$ $x + 3y \geq 80$ $x \geq 0,\ y \geq 0$

$(E).$

Maximize	$Z = 20x + 20y$
Constraints	$2x + y \leq 80$ $x + 3y \leq 120$ $x \geq 0,\ y \geq 0$

14Q.14. Rolf170TB95. The probability a coffee shop customer uses sugar is 0.45, the probability of using cream is 0.35, and the probability of using both is 0.20.

Find the probability that a customer uses sugar or cream or both.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	0.80	
$B \longrightarrow$	0.60	
$C \longrightarrow$	0.45	
$D \longrightarrow$	1.00	
$E \longrightarrow$	0.3575	

15Q.15. Rolf179TB162. A student applies for two different scholarships.

The probability of receiving the first scholarship is 0.3 and the probability of receiving the second scholarship is 0.4.

The decisions are made independently.

Find the probability the student receives exactly one scholarship.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	0.12	
$B \longrightarrow$	0.42	
$C \longrightarrow$	0.46	
$D \longrightarrow$	0.44	
$E \longrightarrow$	0.40	

16Q.16. Rolf125TB74. Tony invested some money at 10 % compounded quarterly at the end of three years his investment had grown to \$2488.05.

Find the initial (principal) investment.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	\$ 1850.00	
$B \longrightarrow$	\$ 1640.00	
$C \longrightarrow$	\$ 1518.38	
$D \longrightarrow$	\$ 1760.00	
$E \longrightarrow$	\$ 1749.39	

17Q.17. For the standard Minimum Problem

Minimize $z = 8x_1 + 4x_2 + 9x_3$, subject to constraints

$$\begin{cases} x_1 + 2x_2 + 5x_3 \geq 40 \\ 3x_1 + 4x_2 + x_3 \geq 50 \\ 2x_1 + 6x_2 + 7x_3 \geq 60 \\ x_1 \geq 0, \; x_2 \geq 0, \; x_3 \geq 0 \end{cases}$$

Find the DUAL of it and then write the Initial Tableau of the standard maximum linear programming problem.

$$(A).\begin{bmatrix} 1 & 2 & 5 & 1 & 0 & 0 & 0 & : & 40 \\ 3 & 4 & 1 & 0 & 1 & 0 & 0 & : & 50 \\ 2 & 6 & 7 & 0 & 0 & 1 & 0 & : & 60 \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ 8 & 4 & 9 & 0 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

$$(B).\begin{bmatrix} 1 & 2 & 5 & 1 & 0 & 0 & 0 & : & 40 \\ 3 & 4 & 1 & 0 & 1 & 0 & 0 & : & 50 \\ 2 & 6 & 7 & 0 & 0 & 1 & 0 & : & 60 \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ -8 & -4 & -9 & 0 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

$$(C).\begin{bmatrix} 1 & 2 & 5 & 1 & 0 & 0 & 0 & : & 8 \\ 3 & 4 & 1 & 0 & 1 & 0 & 0 & : & 4 \\ 2 & 6 & 7 & 0 & 0 & 1 & 0 & : & 9 \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \cdots \\ 40 & 50 & 60 & 0 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

$$(D).\begin{bmatrix} 1 & 3 & 2 & 1 & 0 & 0 & 0 & : & 8 \\ 2 & 4 & 6 & 0 & 1 & 0 & 0 & : & 4 \\ 5 & 1 & 7 & 0 & 0 & 1 & 0 & : & 9 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ -40 & -50 & -60 & 0 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

$$(E).\begin{bmatrix} 1 & 2 & 5 & 1 & 0 & 0 & 0 & : & 8 \\ 3 & 4 & 1 & 0 & 1 & 0 & 0 & : & 4 \\ 2 & 6 & 7 & 0 & 0 & 1 & 0 & : & 9 \\ \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots & \dots \\ -40 & -50 & -60 & 0 & 0 & 0 & 1 & : & 0 \end{bmatrix}$$

18Q.18. TB4.3.19MC140. The demand function for a manufacturer's product is

$p = f(q) = 800 - 2q,$

where p is the price (in dollars) per unit when q units are demanded (per week).

Find the level of production that maximizes the manufacturer's total revenue.

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	100	
$B \longrightarrow$	125	
$C \longrightarrow$	150	
$D \longrightarrow$	175	
$E \longrightarrow$	200	

19Q.19. TB4.4.21.MC146. An automobile factory produces two models.

The first model requires 1 hour to paint and $\frac{1}{2}$ hour to polish.

The second model requires 1 hour for each process.

During each hour that the assembly line is operating, there are 100 hours available for painting and 80 hours for polishing.

How many of the first model can be produced each hour if all the hours available are to be used?

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	70	
$B \longrightarrow$	60	
$C \longrightarrow$	50	
$D \longrightarrow$	40	
$E \longrightarrow$	30	

20Q.20. TB4.5.4MC151. One solution of the system

$$\begin{cases} x - y^2 = 0 \\ 3x + 2y - 5 = 0 \end{cases}$$

is $x = 1$ and $y = 1$.

Another solution is

Letter Choice	Possible Answer	Check($\surd$)
$A \longrightarrow$	$x = \frac{9}{25}$, $y = -\frac{3}{5}$.	
$B \longrightarrow$	$x = \frac{25}{9}$, $y = -\frac{5}{3}$.	
$C \longrightarrow$	$x = \frac{49}{2}$, $y = -\frac{7}{2}$.	
$D \longrightarrow$	$x = \frac{25}{9}$, $y = \frac{5}{3}$.	
$E \longrightarrow$	$x = 1$, $y = -1$.	