# Prince Sultan University
## Department of Mathematics and General Sciences
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**Finite Mathematics**

Math 101

Final Exam

Term 151

Saturday, December 26, 2015


Time Allowed: 120 minutes

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**Name:**

**Student Number:**

**Section:**

Dr. Jehad 8.00 or Dr. Jehad 11.00 / Mr. Abid / Dr. Muhammad

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**Statement of Ethics:**


I agree to complete this exam without unauthorized assistance from any person, materials, or device.



**Signature:** _____

| Problems | Max points | Student's Points |
|----------|-----------|------------------|
| 1-3 | 16 | |
| 4-5 | 10 | |
| 6-7 | 10 | |
| 8 | 10 | |
| 9-10 | 14 | |
| 11-14 | 20 | |
| | | |
| Total | 80 | |
| Total | 40 | |

**Q1** [4 points] Solve for the equation $\dfrac{1}{3x+1} + \dfrac{2}{x+1} = 3$

**Q2** [6 points] Suppose the cost to produce 10 units of a product is $40 and the cost to produce 20 units is $70. If the cost $c$ is linearly related to output $q$, find a linear equation relating $c$ and $q$. Use this equation to find the cost to produce 35 units.

**Q3** [6 points] Consider the function $f(x) = -2x^2 - 6x$.

a) Find the vertex, intercepts and range of $f(x)$

b) Identify whether $f(x)$ has a maximum value or a minimum value, and find that value.

c) Sketch the graph of $f(x)$.
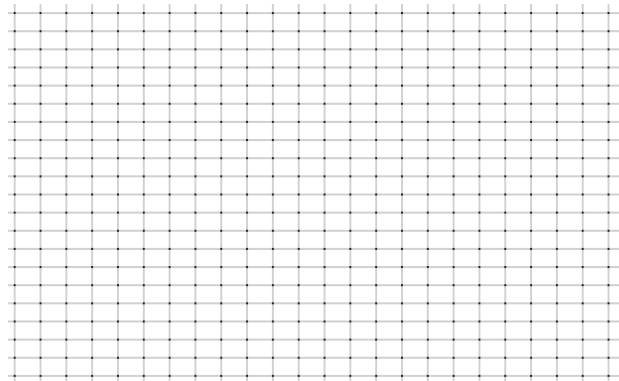
**Q4** [4 points] Find the present value of an annuity of $100 per month for $3\frac{1}{2}$ years at an interest rate of 6% compounded monthly.

**Q5** [6 points] Given that $\qquad A = \begin{bmatrix} -1 & 0 \\ 3 & -2 \end{bmatrix} \qquad B = \begin{bmatrix} 5 & -2 & 1 \\ 0 & 1 & -1 \end{bmatrix} \qquad C = \begin{bmatrix} 2 & 0 \\ -1 & 3 \\ 0 & 1 \end{bmatrix}$
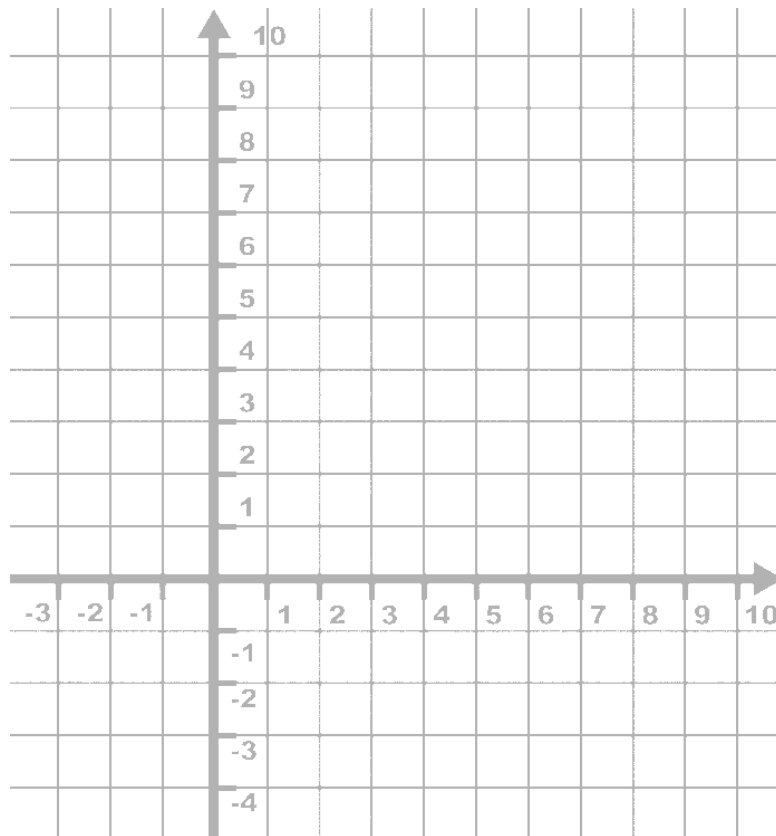
Find the following:

a) $\left( \left( A^{-1} \right)^T \right)^T$

b) $2B \times 3C$

c) $\frac{1}{2}B - \frac{1}{3}C$

**Q6** [4 points] Given that $\begin{bmatrix} 0 & \frac{-1}{2} & 1 \\ \frac{-1}{2} & \frac{1}{4} & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{4} & \frac{-1}{2} \end{bmatrix}$ is **the inverse** of the coefficient matrix of $\begin{cases} x \ +2z = 1 \\ 2y+2z = 3, \\ x+y+z = 5 \end{cases}$ solve

the system using the inverse of the  coefficient matrix.

**Q7** [6 points] Maximize the objective function $Z = 2x+3y$ subject to $\begin{cases} -2x+5y \leq 10 \\ 4x+5y \leq 40 \\ x \geq 0 \\ y \geq 0 \end{cases}$ by **graphing.**

**Q8** [10 points] Use the **Simplex Method** to Maximize $Z = 2x + y$ subject to $\begin{cases} x + y \le 6 \\ -x + y \ge 4 \\ x \ge 0, y \ge 0 \end{cases}$ .

**Q9** [4 points] Suppose a club is named by three Arabic letters (There are 28 letters in the Arabic alphabet).

   a) How many names are possible?

   b) How many names are possible if no letter can be used more than one time?

**Q10** [10 points] A coin is tossed three times in succession and the results are observed. Determine each of the following:

   a) The usual sample space $S$

   b) The event $E$ that at least one head occurs

   c) The event $F$ that at least one tail occurs

   d) $E \cup F$.

   e) Are the events $E$ and $F$ mutually exclusive? Explain your answer.

**Q11** [4 points] How many distinguishable arrangements of all the letters in the word **DIFFERENTIATION** are possible?

**Q12** [4 points] There are 20 students in the Math club. In how many ways can a subcommittee of 3 members be formed?

**Q13** [6 points] The following table summarizes the graduating class of a university:

|  | Arts and Science (A) | Education (E) | Business (B) | Total |
|---|---|---|---|---|
| Male (M) | 342 | 424 | 682 | 1448 |
| Female (F) | 324 | 102 | 144 | 570 |
| Total | 666 | 526 | 826 | 2018 |

A student is selected at random from the graduating class. Find the probability that the student

a) is male

b) is receiving an arts and science degree.

c) is a female receiving a business degree.

**Q14** [6 points]

a) The odds that $E$ will occur are $3:7$. Find $P(E)$.

b) A Bahrain TV weather forecast reports a 75% chance of rain tomorrow. What are the odds that it will rain tomorrow?

# Formula sheet Math 101 (Finite Math)

## Simple interest

$I=Prt$     ($P$ is principal, $r$ is percentage rate, and $t$ is the time in years)

## Future Value of Simple interest (S)

$$S = P(1+rt)$$

## Future value of Compound Interest

$$S = P\left(1+\frac{r}{n}\right)^{nt}$$

## Effective Rate $(r_e)$

$$r_e = \left(1+\frac{r}{n}\right)^{n} - 1$$

## Present value of Annuity

$$A = R\frac{1-(1+r)^{-n}}{r}$$

Where $A$ is the present value of ordinary annuity
$R$ is payment
$n$ is the total number of payments
$r$ is percentage interest rate