UNIVERSITY OF JOHANNESBURG

FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED MATHEMATICS

MODULE: **BASIC MATHEMATICS AND APPLICATIONS IN ECONOMICS AND BUSINESS B – MAEB0B1 & MAEB322**

CAMPUS: **APK**

ASSESSMENT: **EXAM**

DATE: **31 OCTOBER 2015**

ASSESSORS: **MR RJ MAARTENS**
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INTERNAL MODERATOR: **DR UA KOUMBA**

DURATION: **2 HOURS**

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INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

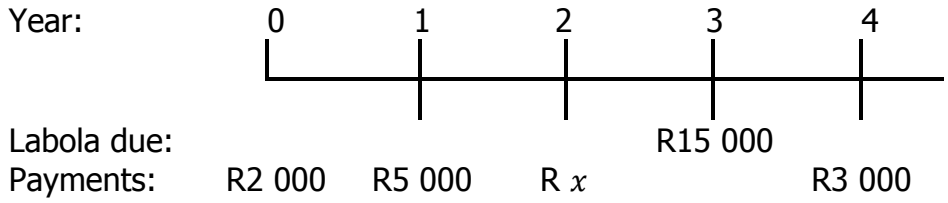
NUMBER OF PAGES: 15 (INCLUDING COVER PAGE AND ANNEXURE A)

INSTRUCTIONS:

- **ANSWER ALL THE QUESTIONS IN PEN**
- **NO REMARK ON PENCIL, NO TIPEX ALLOWED**
- **ALL GRAPHS MUST BE DRAWN IN PEN**
- **STATE ALL FORMULAS USED, MARKS ARE GIVEN TO FORMULAS**
- **SHOW ALL THE NECESSARY CALCULATIONS**
- **IF NECESSARY ROUND OFF TO TWO DECIMAL PLACES**
- **SCIENTIFIC CALCULATORS ARE ALLOWED**
- **QUESTIONS CAN BE ANSWERED IN ANY ORDER**

Question 1 [6]

Sipho wants to marry Mubedi but her father insists that he must first pay R15 000 labola. Sipho negotiates with the father to pay the labola over a few years as he is still searching for a decent job. They agree to the following payments:



If money is worth 12% compounded quarterly, determine the value of x.

Question 2 [12]

A borrower is repaying a R550 000 loan at 7.5% per year, compounded monthly, with monthly payments over 20 years.

2.1 Determine the monthly payment. (3)

2.2 Determine the balance outstanding after the 70th payment. (3)

2.3 Determine the interest contained in the 20th payment. (3)

2.4 Determine the finance charge. (3)

Question 3 [8]

Graph the following inequalities and clearly indicate the feasible region for each question separately.

3.1 $3x + 4y \leq 24$ (2)

3.2 $2y > x - 4$ (2)

3.3 $\begin{cases} x + y \leq 100 \\ 2x + 3y \geq 150 \\ x \geq 0 \\ y \geq 0 \end{cases}$ (4)

Question 4 **[3]**

For the following word problem, only write down the system of constraints.

A company produces two types of mixers: manual and electric. Each requires in its manufacture the use of three machines: A, B, and C. Each manual mixer requires the use of machine A for 4 hours, machine B for 3 hours, and machine C for 1 hour. An electric mixer requires 1 hour on A, 2 hours on B, and 2 hours on C.

Furthermore, suppose the maximum numbers of hours available per month for the use of machines A, B, and C are 380, 260, and 200, respectively. The profit on a manual mixer is $45, and on an electric mixer it is $56.

Question 5 **[3]**

For the following equation:

$$2x^5 + 4y^3 = 16$$

Determine $\frac{dx}{dy}$.

Question 6 **[10]**

Differentiate each of the following functions with respect to x. You do not need to simplify your solution.

6.1 $f(x) = x^3 + 7x^{-2} + 18 - \sqrt{x}$ (2)

6.2 $g(x) = \ln(2x^3 + 2x - 6)$ (2)

6.3 $h(x) = \frac{4x^2+3x-9}{e^{2x}-1}$ (3)

6.4 $j(x) = (2x^3 + 2x - 6)^{20} . (1 - x^2)^{-3}$ (3)

Question 7 **[3]**

A manufacturer determines that m employees will produce a total of q units of a product per day, where

$$q = 6m^3 - e^{0.2m}.$$

If the total revenue equation for the product is

$$r = \ln(q)$$

determine the marginal-revenue product when $m = 3$.

Question 8 [7]

Given the following data set:

7 10 9 6 4 7 6

8.1 Determine the mean, mode and median. (3)

8.2 Determine the standard deviation after completing the table below. (4)

i	x_i	$x_i - mean$	$(x_i - mean)^2$
1.	7		
2.	10		
3.	9		
4.	6		
5.	4		
6.	7		
7.	6		
		TOTAL	

Question 9 [2]

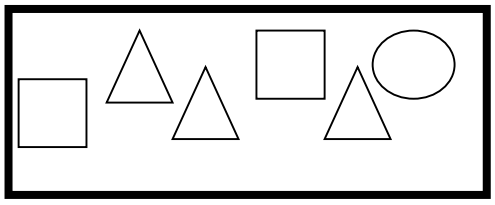
Let S be the sample space of a die, and define the following three events on S:

$A = \{\text{even numbers}\}$ $B = \{\text{odd numbers}\}$ $C = \{3,6\}$

Draw a Venn diagram to illustrate S, A, B and C.

Question 10 [6]

The following box contains 3 triangles, 2 squares and 1 circle:



You draw two shapes from the box at random; first the one and then the second. If replacement is **NOT** allowed,

10.1 Draw a complete tree diagram illustrating all possibilities and probabilities. (3)

10.2 Determine the probability of first drawing a circle and then a triangle. (1)

10.3 Determine the probability of drawing two identical shapes. (2)

Question 11 [6]

A few students at UJ filled out an entry form for a competition to win an iPod. Here are their names and their ages:

Boys	Ages	Girls	Ages
Nathan	18	Nomsa	18
Marie	19	Francine	18
Jonathan	22	Delia	23
Mutumi	24	Gracie	27
John	17	Petro	19
David	25	Violet	18
Rafael	25	Morwesi	25
		Charisa	24

Each student has the same probability of winning, and there can only be one winner.

Given the following events:

E_1 : *A boy wins*
E_2 : *An 18-year-old wins*
E_3 : *The winner's name starts with an "N"*
E_4 : *A 25-year-old wins*

Determine:

11.1 $P(E_4)$ (1)

11.2 $P(\overline{E_4})$ (1)

11.3 $P(E_2 \cap E_4)$ (1)

11.4 $P(E_2 \cap E_3)$ (1)

11.5 $P(E_1 \cup E_4)$ (2)

Question 12 (Round off to 4 decimal places here) [7]

One of your investments on the Johannesburg Stock Exchange (JSE) is currently trading around a mean of \$10 with a standard deviation of \$10.

12.1 Calculate the probability that your stock will trade below \$5. (3)

12.2 Calculate the probability that your stock will trade between \$13 and \$25.50. (4)

End of Assessment – Total Marks: 73

ANNEXURE A

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990