



FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

MODULE: MATHEMATICS FOR FINANCE AND BUSINESS 1B– MATDCB1

CAMPUS: APK/SWC

ASSESSMENT: SUPPLEMENTARY EXAM

DATE: JANUARY 2020

ASSESSORS: MS M JUGA
MR T MOHUBEDU
MR MSW POTGIETER

INTERNAL MODERATOR: DR. J MBA

DURATION: 2 HOURS

76

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: 15 (INCLUDING COVER PAGE)

INSTRUCTIONS:

- ANSWER ALL THE QUESTIONS IN PEN.
- ALL GRAPHS MUST BE DRAWN IN PEN.
- NO PENCIL OR TIPEX ALLOWED.
- SHOW ALL THE NECESSARY CALCULATIONS CLEARLY.
- IF FORMULAS ARE USED THEY MUST BE STATED AS MARKS ARE GIVEN TO THEM.
- ONLY SCIENTIFIC CALCULATORS ARE ALLOWED.
- IF NECESSARY, ROUND OFF TO TWO DECIMAL PLACES.
- THE QUESTIONS CAN BE ANSWERED IN ANY ORDER.

Question 1**[11]**

- 1.1 Maxi needs to save up R 15,000.00 in three years' time for school. Determine her deposit if her accounts earn 9% per year, compounded continuously. [3]
- 1.2 Tsidi would like to open a savings account and approaches several banks. The three interest rate options she is given are:
A, 4.1% per year compounded daily.
B, 4.15% per year compounded weekly.
C, 4.19% per year compounded monthly.
Calculate the effective rate for each option and select the best option for Tsidi. [5]



-
- 1.3 How long will it take to triple an investment subjected to an interest rate of 9.55% per year compounded semi-annually. [3]

Question 2**[13]**

Janet is saving up to purchase a local business. When she had R 150,000.00 saved the business was put up for sale. The owner accepted Janet's offer which was 85% of R 500,000.00 price. Her savings is not enough and decides to take out a loan to complete the purchase. The loan is to be repaid with monthly payments over 15 years and the loan is subjected to an interest rate of 9% per year compounded monthly.

Determine:

- 2.1 The required monthly payment. [3]

- 2.2 The principle outstanding after the 23rd payment. [2]



2.3 The principle outstanding at the beginning of 16th month. [2]

2.4 The interest repaid in the 16th month. [2]

2.5 The principle repaid with the 16th payment. [2]

2.6 The finance charge. [2]



Question 3**[7]**

You have to repay a debt of R 4,000.00 in due in 5 years' time and a debt of R 8,000.00 due int 8 years' time. Instead you make a payment of R 2,000.00 now and a final payment after 10 years.

3.1 Sketch a timeline, indicating all debts, payment and years. [2]

3.2 Calculate the value of the final payment. [5]

Question 4**[3]**

Surefire LLC will need to replace a milling machine in 5 years' time. To do this the company starts a sinking fund making monthly contributions of R 10,000.00. The machine will cost R 1,500,000.00 in 5 years' time. If the interest rate is 9% per year, will they have sufficient funds to purchase the new machine. Motivate your answer.



Question5**[10]**

Differentiate the following, but **do not simplify** your answer:

5.1 $y = e^x + \ln x - 4x^2$ [3]

5.2 $y = (2x^5 - 4x^2)(3x^{-3} + 5x^3)$ [2]

5.3 $y = \frac{5x^4 - 2x}{2x^4 - 4x^3}$ [3]

5.4 $f(x) = (e^x - 4x^5)^{50}$ [2]



Question 6**[4]**

Find the fourth derivative, $y^{(4)}$, of the given function:

$$y = e^{4x}$$

Question 7**[4]**

Given the following Average cost function:

$$AC = 2,000q^4 + \frac{2,000}{q}$$

7.1 Determine the total cost function when $q = 500$.

[2]

7.2 Determine the marginal cost function. [1]

7.3 If the production quantity is to be increased by 1 unit at a present production level of 1000 units, determine by how much the total cost would increase [1]



Question 8**[6]**

In preparation for the 2019 Rugby World Cup, the Springboks reviewed previous games played against the All Blacks. The scores for the last 13 games played are presented below:

7, 7, 5, 5, 5, 0, 10, 15, 18, 17, 5, 8, 7,

- 8.1 Complete the following grouped frequency table using the given information above. [3]

Class	Count	Frequency	Relative Frequency
1-5			
6-10			
11-15			
16-20			
TOTAL			

- 8.2 Determine the following parameters using the information presented in Table 1: [3]

Mean	
Mode	
Median	

Question 9**[5]**

Suppose a coin is tossed three times with the orientation of the coin being recorded when it lands. Then:

$$S = \{TTT, TTH, THT, HTT, THH, HTH, HHT, HHH\}$$

is the sample space of the experiment with events:

$$A = \{TTH, THT, HHT, TTT, HHH\} \quad \text{and} \quad B = \{HHT, HTH, THH\}.$$



9.1 Determine $P(B)$. [1]

9.2 Determine $P(A \cap B)$. [1]

9.3 Determine $P(A \cup B)$. [1]

9.4 Determine $P(B|A)$. [1]

9.5 Are events A and B mutually exclusive? Motivate your answer. [1]

Question 10 [4]

Given the following probabilities:

$$P(A) = 0.3, P(A \cup B) = 0.9 \text{ and } P(B) = 0.6$$

10.1 Determine the probability of A or B, $P(A \cap B)$. [2]



10.2 Are events A and B mutually exclusive? (YES or NO). Motivate your answer. [2]

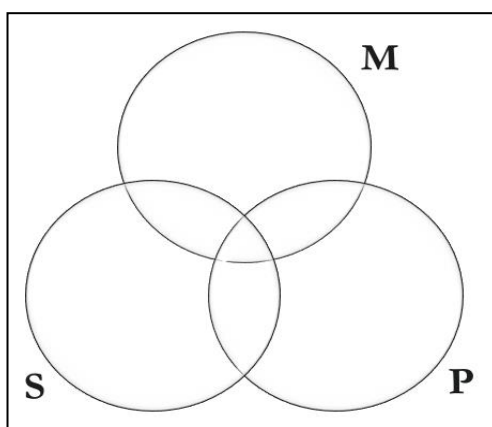
Question 11

[2]

On the provided Venn Diagram shade the region that represents:

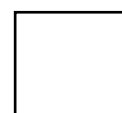
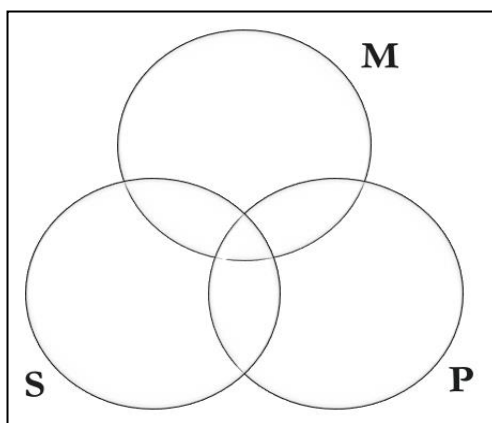
11.1 $S \cap M \cap P$

[1]



11.2 $M \cap P$

[1]



Question 12**[7]**12.1 If $X \sim N(50, 49)$, use Annexure B to determine $P(X > 46)$.**[3]**12.2 If $X \sim N(100, 225)$, use Annexure B to determine $P(96 < X < 104)$.**[4]****End of Assessment – Total 76 Marks****ANNEXURE A**

$R \frac{r}{m} \left[\frac{1 - \left(1 + \frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}} \right]$	$R \left[1 - \frac{r}{m} \times \frac{1 - \left(1 + \frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}} \right]$	
$nmR - A$	$R \left[\frac{1 - \left(1 + \frac{r}{m}\right)^{-nm}}{\frac{r}{m}} \right]$	$R \left[\frac{1 - \left(1 + \frac{r}{m}\right)^{-nm+k-1}}{\frac{r}{m}} \right]$



$A = R \left[\frac{1 - \left(1 + \frac{r}{m}\right)^{-mn}}{\frac{r}{m}} \right]$	$A = \frac{R}{\frac{r}{m}}$	$MPC + MPS = 1$
$A = P(1 + rn)$	$A = P \left(1 + \frac{r}{m}\right)^{mn}$	$S = R \left[\frac{\left(1 + \frac{r}{m}\right)^{mn} - 1}{\frac{r}{m}} \right]$
$A = R \left[\frac{1 - \left(1 + \frac{r}{m}\right)^{-(mn-1)}}{\frac{r}{m}} + 1 \right]$	$S = R \left[\frac{\left(1 + \frac{r}{m}\right)^{mn+1} - 1}{\frac{r}{m}} - 1 \right]$	$r_E = \left(1 + \frac{r}{m}\right)^m - 1$

ANNEXURE B

	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

Use this space if you want to redo a question. Clearly indicate at the question that the answer is on Page 14/15.

