



FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

MODULE: MATHEMATICS FOR FINANCE AND BUSINESS 1B– MATDCB1

CAMPUS: APK/SWC

ASSESSMENT: EXAM

DATE: NOVEMBER 2019

ASSESSORS: MS M JUGA
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INTERNAL MODERATOR: DR. J MBA

DURATION: 2 HOURS

77

INITIALS AND SURNAME: _____

STUDENT NUMBER: _____

CONTACT NUMBER: _____

NUMBER OF PAGES: 13 (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**[8]**

- 1.1 Thapelo has a bank account earning 4.75% per year compounded quarterly. He manages to triple the money in his account. How many years did it take? Round up to the nearest year. [3]
- 1.2 Eve calculated that she will need to withdraw R 9,000.00 every month from her retirement fund, after she retires. If her pension savings earn 10% per year compounded monthly, determine the required value of her pension fund when she retires. Assume the account functions as a perpetuity. [3]
- 1.3 Convert a nominal interest rate of 1.5%, compounded daily, to an effective rate. [2]



Question 2**[11]**

Jerome is looking at opening a machine shop, in order to do so he must purchase a piece of land. The asking price for the selected piece of land is R 1,500,000.00. Jerome puts in an offer of 60% of the purchase price. and the seller counters with 70% of the purchase price. Jerome accepts this offer but only has R 600,000.00 on hand as an initial payment. A loan must be taken out for the remaining amount. The loan is subject an interest rate of 7.3% per year compounded quarterly and is repaid over 35 years

Determine:

2.1 The quarterly payment. [2]

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

2.3 The interest contained in the 16th payment. [2]

2.4 The finance charge. [2]



2.5 If the loan is **rather** repaid in 3 quarterly payments of. Draw up an amortisation schedule for the situation. [3]

Period	Principle Outstanding at Beginning	Interest for the Period	Payment at the End of the Quarter	Principle Repaid at End
1				
2				
3				
Total	-----			

Question 3

[4]

You have been given the opportunity to invest in a small printing company. If you make an immediate investment of R100,000.00 the company guarantees the following returns:

YEAR	CASH FLOW
1	R65,000.00
2	R15,000.00
6	R15,000.00
10	R20,000.00

Assume an interest rate of 9% per year, compounded monthly.

3.1 Determine the net present value (NPV) of the cash flows.

[3]

3.2 Is the investment profitable? (**YES** OR **NO**)

[1]



Question 4**[4]**

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.

Question 5**[11]**

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

5.1 $y = 4x^3 - 9x^2 + e^x - 9$ [4]

5.2 $y = (3x^5 - 9x^2)(4x^{-9} + 2x^8)$ [2]

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



5.4 $f(x) = (3x^2 - 4x^5)^{50}$ [2]

Question 6 [5]

Find the second derivative, y'' , of the given function:

$$y = \ln(2x^4 - 2x^2 + 5x)$$

Question 7 [6]

Nelson and Tshepo are B.Com Financial Management graduates from UJ. Upon graduating, they started a business specialising in the design and manufacturing of soccer boots, *Sport Supreme Plus*, which is aimed at the school and student market. Nelson and Tshepo have decided to employ a business analyst in order to aid them in optimising their business. The analyst determined the following economic functions:

$$\text{Average Cost (AC)} = 3q + \sqrt[2]{q^4} + \frac{5000}{q} \qquad \text{Price (P)} = \frac{2}{q} + 2\sqrt{q^3}$$

Round your answer to **two (2) decimal places** where applicable, and determine the:

7.1. Total Cost (TC) function. [1]	7.2. TC at $q = 10$. [1]



7.3. Marginal Cost (MC) function. [1]	7.4. MC at $q = 10$. [1]
7.5. Total Revenue (TR) function. [1]	7.6. Marginal Revenue (MR) function. [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 15 games played are presented below:

5, 9, 0, 17, 6, 11, 5, 7, 13, 17, 15, 12, 9, 11, 6

- 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			
21-25			
TOTAL			

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

Mean	
------	--



Mode	
Median	

Question 9**[8]**

A bag contains 3 green balls and 6 yellow balls. Paul picks a ball at random from the bag and replaces it back in the bag. He mixes the balls in the bag and then picks another ball at random from the bag

9.1 Draw a tree diagram detailing all of the possible outcomes for the experiment. Indicate all probabilities. [4]

9.2 Calculate the probability of Paul picking 2 green balls. [1]

9.3 Determine the probability of not picking a yellow ball. [1]

9.4 Determine the probability of Paul picking a yellow and a green ball. [1]



9.5 What is the probability that Paul will have picked at least 1 yellow ball. [1]

Question 10 [4]

Given the following probabilities:

$$P(A) = 0.3, P(A \cap B) = 0.2 \text{ and } P(B) = 0.6$$

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

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

Question 11 [10]

10.1 If $X \sim N(29, 4)$, use Annexure B to determine $P(X > 27.9)$. [3]



10.2 If $X \sim N(100, 225)$, use Annexure B to determine $P(80 < X < 105)$. [4]

10.3 Let X denote Miriam's monthly living expenses. X is normally distributed with mean $\mu = \$1,000$ and standard deviation $\sigma = \$150$. On Jan. 1, Miriam finds out that her money supply for January is \$1,150. What is the probability that Miriam's money supply will run out before the end of January? [3]

End of Assessment – Total 77 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 13.



