UNIVERSITY OF COLOMBO, SRI LANKA

FACULTY OF ARTS

FIRST YEAR EXAMINATION IN ARTS (SEMESTER II) – 2016/2017

FND 1206 – INTERMEDIATE MATHEMATICS

(Time: Two Hours)

Answer any five (05) questions

No. of questions: 07

No. of pages: 05

(Each question carries equal marks)

Calculators are not permitted

01.

i. Evaluate.

$5^0 + 15^0$ **(3 marks)**

ii. Simplify.

$3\frac{1}{2} - \frac{1}{5}\left(\frac{1}{2} \times \frac{4}{3}\right)$ **(8 marks)**

iii. Express in the simplest form.

$1\ cm : 10\ mm : 20\ mm$ **(3 marks)**

iv. Make r as the subject of the formula.

$P = Ae^{rt}$ **(4 marks)**

v. Evaluate.

$2 \log_{13} 1$ **(2 marks)**

(Total: 20 marks)

02.

i. Solve the following inequality and represent the solution on a number line.

$$\frac{2}{3}(x + 5) \leq x - 2$$

(6 marks)

ii. In a map, the distance between two towns is 25 cm. If the actual distance between that two towns is 50 km, then find the ratio of the map has been drawn. **(5 marks)**

iii. Solve for t.

$|3t + 5| = \frac{1}{2}$ **(5 marks)**

iv. Factorize.

$2 - q^2$ **(4 marks)**

(Total: 20 marks)

03.

i. An investigation was conducted by 50 persons of growing tea, coconut and rubber in Kegalle district.

- 18 of them grow tea and coconut
- 5 grow tea and rubber only
- 35 grow coconut
- 27 do not grow tea
- 4 grow rubber only

(a) How many people grow tea? **(2 marks)**

(b) Represent the above data of planters in a Venn diagram. **(5 marks)**

(c) How many people grow tea only? **(3 marks)**

(d) Dark the area which denotes, people who grow all the three plants. **(3 marks)**

ii. Let $A = \{Letters\ of\ the\ word, "KEGALLE"\}$.

(a) List the elements of set A. **(5 marks)**

(b) How many subsets of set A? **(2 marks)**

(Total: 20 marks)

04.

i. In a random experiment, an unbiased die and an unbiased coin have flipped.

(a) Write down the event space of the experiment. **(6 marks)**

(b) What is the probability of getting both a head and an odd number? **(2 marks)**

(c) What is the probability of getting an even number? **(3 marks)**

ii. An electric circuit is designed as the following way.

- A biased coin is flipped.
- If tail occurs then current will pass.

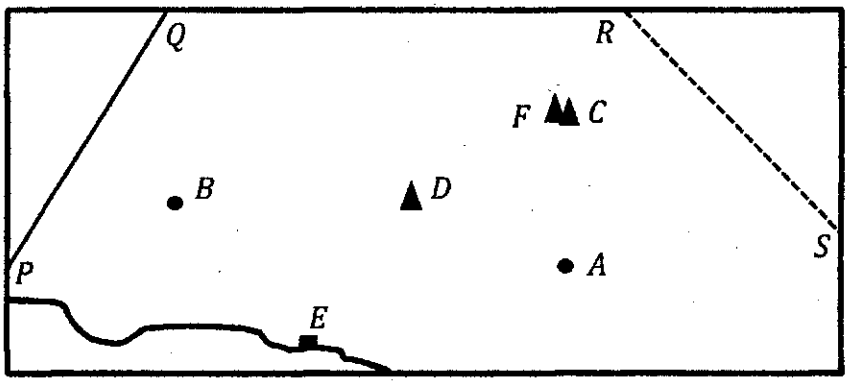
The probability of that head occurs from the given coin is 0.4. If tail occurs, then the probability of a bulb lights is 0.5.

(a) What is the probability of that tail occurs from that biased coin? **(2 marks)**
(b) Construct a tree diagram to represent the process of this circuit. **(4 marks)**
(c) Find the probability of a bulb lights. **(3 marks)**

(Total: 20 marks)

05.

A map of a certain area is given in the following diagram.



Here, A and B are two towns which are situated in the coordinates of $(-1,5)$ and $(3,2)$ respectively. D is a top of a rock of height $200\ m$. C and F are two neighbouring points in a same mountain.

(i) Find the straight distance between two towns, A and B. **(6 marks)**
(ii) An observer, who is on the top of the rock D, observes a boat E, which rides in the river, which flows in the area, by a depression angle of 45°. Find the straight distance between the boat and the bottom of the rock. **(4 marks)**
(iii) If C and F points are situated in the coordinates of $(3,8)$ and $(-4,-6)$ respectively, then find the slope of the mountain, which C and F are situated. **(4 marks)**

(iv) PQ is a straight highway, which is situated on the line, $5y = 4x + 3$. Write down the gradient and the intercept of the line PQ. **(3 marks)**

(v) RS is a straight train line, which is perpendicular to the line, $y = -2x + 6$ and going through the origin. Find the equation of the line RS. **(3 marks)**

(Total: 20 marks)

06.

An investor bought stocks in two consecutive months as the following.

	Number of stocks	
	Facebook	Google
1st Month	12	8
2nd Month	5	20

Price of a stock in Facebook company was Rs. x and price of a Google company was Rs.y. The total investment in the 1st month was Rs. 10 400 and in the 2nd month, it was Rs. 21 000.

Given $A = \begin{pmatrix} 12 & 8 \\ 5 & 20 \end{pmatrix}$, $B = \begin{pmatrix} x \\ y \end{pmatrix}$ and $C = \begin{pmatrix} 10\,400 \\ 21\,000 \end{pmatrix}$.

(i) What is the order of the matrix A? **(2 marks)**

(ii) Construct an equation connecting A, B and C. **(2 marks)**

(iii) Find $|A|$. **(4 marks)**

(iv) Find A^{-1}. **(5 marks)**

(v) If $B = A^{-1}C$, then find B. **(5 marks)**

(vi) What can you say about x and y? **(2 marks)**

(Total: 20 marks)

07.

i. Consider the following function.

$$g(x) = \frac{x^3 + 5x^2 + 3}{2x^3 - 3x - 1}$$

(a) When $x \to \infty$, what is the value of numerator? **(2 marks)**

(b) When $x \to \infty$, what is the value of denominator? **(2 marks)**

(c) Find the value of $\lim_{x \to \infty} g(x)$ **(6 marks)**

ii. Population in a certain area is described by the following equation.

$$y(t) = 2e^t - 3t^2 + 100$$

Here, y- population in the area at time t

t- time in years

(a) Initially, that is when $t = 0$, what was the population in the area? **(3 marks)**

(b) If the rate of change of population is given by $\frac{dy}{dt}$, then find $\frac{dy}{dt}$. **(3 marks)**

(c) Due to a certain infection in that area, the population has changed as following.

$$y(t) = -5t^2 + 100$$

Find the duration that takes to have a zero population. **(4 marks)**

(Total: 20 marks)

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	0'	10'	20'	30'	40'	50'	60'		මධ්‍යන්‍ය අන්තරය இடை வித்தியாசங்கள் Mean Differences 1'	2'	3'	4'	5'	6'	7'	8'	9'
0°	0.0000	0.0029	0.0058	0.0087	0.0116	0.0145	0.0175	89°	3	6	9	12	15	17	20	23	26
1	.0175	.0204	.0233	.0262	.0291	.0320	.0349	88	3	6	9	12	15	17	20	23	26
2	.0349	.0378	.0407	.0437	.0466	.0495	.0524	87	3	6	9	12	15	18	20	23	26
3	.0524	.0553	.0582	.0612	.0641	.0670	.0699	86	3	6	9	12	15	18	20	23	26
4	.0699	.0729	.0758	.0787	.0816	.0846	.0875	85	3	6	9	12	15	18	21	23	26
5	0.0875	0.0904	0.0934	0.0963	0.0992	0.1022	0.1051	84	3	6	9	12	15	18	21	24	26
6	.1051	.1080	.1110	.1139	.1169	.1198	.1228	83	3	6	9	12	15	18	21	24	27
7	.1228	.1257	.1287	.1317	.1346	.1376	.1405	82	3	6	9	12	15	18	21	24	27
8	.1405	.1435	.1465	.1495	.1524	.1554	.1584	81	3	6	9	12	15	18	21	24	27
9	.1584	.1614	.1644	.1673	.1703	.1733	.1763	80°	3	6	9	12	15	18	21	24	27
10°	0.1763	0.1793	0.1823	0.1853	0.1883	0.1914	0.1944	79	3	6	9	12	15	18	21	24	27
11	.1944	.1974	.2004	.2035	.2065	.2095	.2126	78	3	6	9	12	15	18	21	24	27
12	.2126	.2156	.2186	.2217	.2247	.2278	.2309	77	3	6	9	12	15	18	21	24	27
13	.2309	.2339	.2370	.2401	.2432	.2462	.2493	76	3	6	9	12	15	18	22	25	28
14	.2493	.2524	.2555	.2586	.2617	.2648	.2679	75	3	6	9	12	16	19	22	25	28
15	0.2679	0.2711	0.2742	0.2773	0.2805	0.2836	0.2867	74	3	6	9	13	16	19	22	25	28
16	.2867	.2899	.2931	.2962	.2994	.3026	.3057	73	3	6	9	13	16	19	22	25	28
17	.3057	.3089	.3121	.3153	.3185	.3217	.3249	72	3	6	10	13	16	19	22	26	29
18	.3249	.3281	.3314	.3346	.3378	.3411	.3443	71	3	6	10	13	16	19	23	26	29
19	.3443	.3476	.3508	.3541	.3574	.3607	.3640	70°	3	7	10	13	16	20	23	26	29
20°	0.3640	0.3673	0.3706	0.3739	0.3772	0.3805	0.3839	69	3	7	10	13	17	20	23	27	30
21	.3839	.3872	.3906	.3939	.3973	.4006	.4040	68	3	7	10	13	17	20	24	27	30
22	.4040	.4074	.4108	.4142	.4176	.4210	.4245	67	3	7	10	14	17	20	24	27	31
23	.4245	.4279	.4314	.4348	.4383	.4417	.4452	66	3	7	10	14	17	21	24	28	31
24	.4452	.4487	.4522	.4557	.4592	.4628	.4663	65	4	7	11	14	18	21	25	28	32
25	0.4663	0.4699	0.4734	0.4770	0.4806	0.4841	0.4877	64	4	7	11	14	18	21	25	29	32
26	.4877	.4913	.4950	.4986	.5022	.5059	.5095	63	4	7	11	15	18	22	25	29	33
27	.5095	.5132	.5169	.5206	.5243	.5280	.5317	62	4	7	11	15	18	22	26	30	33
28	.5317	.5354	.5392	.5430	.5467	.5505	.5543	61	4	8	11	15	19	23	26	30	34
29	.5543	.5581	.5619	.5658	.5696	.5735	.5774	60°	4	8	12	15	19	23	27	31	35
30°	0.5774	0.5812	0.5851	0.5890	0.5930	0.5969	0.6009	59	4	8	12	16	20	24	27	31	35
31	.6009	.6048	.6088	.6128	.6168	.6208	.6249	58	4	8	12	16	20	24	28	32	36
32	.6249	.6289	.6330	.6371	.6412	.6453	.6494	57	4	8	12	16	20	25	29	33	37
33	.6494	.6536	.6577	.6619	.6661	.6703	.6745	56	4	8	13	17	21	25	29	33	38
34	.6745	.6787	.6830	.6873	.6916	.6959	.7002	55	4	9	13	17	21	26	30	34	39
35	0.7002	0.7046	0.7089	0.7133	0.7177	0.7221	0.7265	54	4	9	13	18	22	26	31	35	40
36	.7265	.7310	.7355	.7400	.7445	.7490	.7536	53	5	9	14	18	23	27	32	36	41
37	.7536	.7581	.7627	.7673	.7720	.7766	.7813	52	5	9	14	19	23	28	32	37	42
38	.7813	.7860	.7907	.7954	.8002	.8050	.8098	51	5	10	14	19	24	29	33	38	43
39	.8098	.8146	.8195	.8243	.8292	.8342	.8391	50°	5	10	15	20	24	29	34	39	44
40°	0.8391	0.8441	0.8491	.8541	0.8591	0.8642	0.8693	49	5	10	15	20	25	30	35	40	45
41	.8693	.8744	.8796	.8847	.8899	.8952	.9004	48	5	10	16	21	26	31	36	41	47
42	.9004	.9057	.9110	.9163	.9217	.9271	.9325	47	5	11	16	21	27	32	37	43	48
43	.9325	.9380	.9435	.9490	.9545	.9601	.9657	46	6	11	17	22	28	33	39	44	50
44	.9657	.9731	.9770	.9827	.9884	.9942	1.0000	45	6	11	17	23	29	34	40	46	51
	60'	50'	40'	30'	20'	10'	0'		1'	2'	3'	4'	5'	6'	7'	8'	9'

ගණිත කෝවගුව இயற்கைக் கோதான்சன்கள NATURAL COTANGENTS

	0'	10'	20'	30'	40'	50'	60'		මධ්‍යන්‍ය අන්තරය இடை வித்தியாசங்கள் Mean Differences 1'	2'	3'	4'	5'	6'	7'	8'	9'
45°	1.0000	1.0058	1.0117	1.0176	1.0235	1.0295	1.0355	44°	6	12	18	24	30	36	41	47	53
46	.0355	.0416	.0477	.0538	.0599	.0661	.0724	43	6	12	18	25	31	37	43	49	55
47	.0724	.0786	.0850	.0913	.0977	.1041	.1106	42	6	13	19	26	32	38	45	51	57
48	.1106	.1171	.1237	.1303	.1369	.1436	.1504	41	7	13	20	27	33	40	46	53	60
49	.1504	.1571	.1640	.1708	.1778	.1847	.1918	40°	7	14	21	28	34	41	48	55	62
50°	1.1918	1.1988	1.2059	1.2131	1.2203	1.2276	1.2349	39	7	14	22	29	36	43	50	58	65
51	.2349	.2423	.2497	.2572	.2647	.2723	.2799	38	8	15	23	30	38	45	53	60	68
52	.2799	.2876	.2954	.3032	.3111	.3190	.3270	37	8	16	24	31	39	47	55	63	71
53	.3270	.3351	.3432	.3514	.3597	.3680	.3764	36	8	16	25	33	41	49	58	66	74
54	.3764	.3848	.3934	.4019	.4106	.4193	.4281	35	9	17	26	35	43	52	60	69	78
55	1.4281	1.4370	1.4460	1.4550	1.4641	1.4733	1.4826	34	9	18	27	36	45	54	63	73	82
56	.4826	.4919	.5013	.5108	.5204	.5301	.5399	33	10	19	29	38	48	57	67	76	86
57	.5399	.5497	.5597	.5697	.5798	.5900	.6003	32	10	20	30	40	50	60	71	81	91
58	.6003	.6107	.6212	.6319	.6426	.6534	.6643	31	11	21	32	43	53	64	75	85	96
59	.6643	.6753	.6864	.6977	.7090	.7205	.7321	30°	11	23	34	45	56	68	79	90	102
60°	1.732	1.744	1.756	1.767	1.780	1.792	1.804	29	1	2	4	5	6	7	8	10	11
61	1.804	1.816	1.829	1.842	1.855	1.868	1.881	28	1	3	4	5	6	8	9	10	12
62	1.881	1.894	1.907	1.921	1.935	1.949	1.963	27	1	3	4	5	7	8	10	11	12
63	1.963	1.977	1.991	2.006	2.020	2.035	2.050	26	1	3	4	6	7	9	10	12	13
64	2.050	2.066	2.081	2.097	2.112	2.128	2.145	25	2	3	5	6	8	9	11	13	14
65	2.145	2.161	2.177	2.194	2.211	2.229	2.246	24	2	3	5	7	8	10	12	14	15
66	2.246	2.264	2.282	2.300	2.318	2.337	2.356	23	2	4	5	7	9	11	13	15	16
67	2.356	2.375	2.394	2.414	2.434	2.455	2.475	22	2	4	6	8	10	12	14	16	18
68	2.475	2.496	2.517	2.539	2.560	2.583	2.605	21	2	4	6	9	11	13	15	17	20
69	2.605	2.628	2.651	2.675	2.699	2.723	2.747	20°	2	5	7	9	12	14	17	19	21
70°	2.747	2.773	2.798	2.824	2.850	2.877	2.904	19	3	5	8	10	13	16	18	21	23
71	2.904	2.932	2.960	2.989	3.018	3.047	3.078	18	3	6	9	12	14	17	20	23	26
72	3.078	3.108	3.140	3.172	3.204	3.237	3.271	17	3	6	10	13	16	19	23	26	29
73	3.271	3.305	3.340	3.376	3.412	3.450	3.487	16	4	7	11	14	18	22	25	29	32
74	3.487	3.526	3.566	3.606	3.647	3.689	3.732	15	4	8	12	16	20	24	29	33	37
75	3.732	3.776	3.821	3.867	3.914	3.962	4.011	14	5	9	14	19	23	28	33	37	42
76	4.011	4.061	4.113	4.165	4.219	4.275	4.331	13	5	11	16	21	27	32	37	43	48
77	4.331	4.390	4.449	4.511	4.574	4.638	4.705	12	6	12	19	25	31	37	44	50	56
78	4.705	4.773	4.843	4.915	4.989	5.066	5.145	11	7	15	22	29	37	44	51	59	66
79	5.145	5.226	5.309	5.396	5.485	5.576	5.671	10°	9	18	26	35	44	53	61	70	79
80°	5.671	5.769	5.871	5.976	6.084	6.197	6.314	9									
81	6.314	6.435	6.561	6.691	6.827	6.968	7.115	8									
82	7.115	7.269	7.429	7.596	7.770	7.953	8.144	7									
83	8.144	8.345	8.556	8.777	9.010	9.255	9.514	6									
84	9.514	9.788	10.078	10.385	10.712	11.059	11.430	5									
85	11.43	11.83	12.25	12.71	13.20	13.73	14.30	4									
86	14.30	14.92	15.60	16.35	17.17	18.07	19.08	3									
87	19.08	20.21	21.47	22.90	24.54	26.43	28.64	2									
88	28.64	31.24	34.37	38.19	42.96	49.10	57.29	1									
89	57.29	68.75	85.94	114.59	171.89	343.77	×	0°									
	60'	50'	40'	30'	20'	10'	0'		1'	2'	3'	4'	5'	6'	7'	8'	9'

ඉක්මන් වශයෙන් වෙනස් වේ
வித்தியாசங்கள் விரைந்து மாறுகின்றன
Differences change rapidly

ගණිත කෝවගුව இயற்கைக் கோதான்சன்கள NATURAL COTANGENTS