UNIVERSIDADE FEDERAL DE SANTA MARIA
CENTRO DE CIÊNCIAS NATURAIS E EXATAS
DEPARTEMENTO DE MATEMÁTICA

DISCIPLINA: MTM224 – Métodos Numéricos Computacionais
CURSO: Ciências da Computação - Bacharelado
HORAS/AULA: 60 hrs **ANO/PERÍODO:** 2024/02 **TURMA:** 15/307
PROFESSOR: Paulo F. C. Tilles

ATIVIDADE AVALIATIVA 03
INTERPOLAÇÃO POLINOMIAL

QUESTÃO 01

Considere o conjunto de pares ordenados (x_k, y_k) disponibilizado nos bancos de dados e assuma que os dados foram obtidos a partir de uma função f, i.e., $y_k = f(x_k)$.

I. Utilize o método de interpolação de Newton (i.e., diferenças divididas) para obter os polinômios interpoladores de ordens 0 à 10 com intuito de estimar o valor da função no ponto z e determine a aproximação mais confiável para este ponto.

II. Faça gráficos dos pares ordenados juntamente com os polinômios interpoladores P_2, P_4, P_6 e P_8 (ordens 2, 4, 6 e 8).

Os bancos de dados e o ponto z a serem utilizados por cada aluno estão especificados na **TABELA I**, enquanto os bancos de dados estão definidos na **TABELA II**.

DIRETRIZES

1. A solução deve conter a tabela de diferenças divididas (valor 5.0), as estimativas dos valores da função no ponto z (valor 2.0), a estimativa mais confiável (valor 1.0) e os gráficos solicitados (valor 2.0).

2. A solução deve ser enviada por email na forma de um único arquivo no formato pdf, com páginas ordenadas e numeradas. Cada aluno deve nomear o seu arquivo conforme descrito na **TABELA III**.

3. Caso a solução apresentada não esteja em conformidade com alguma destas diretrizes a nota será nula.

TABELA I

Aluno	Banco de dados	z	Aluno	Banco de dados	z
ALAN BESSAUER LENCINA	Data 01	0.848	ALEXANDRE CHAGAS BRITES	Data 02	0.726
ANA LILIAN ALFONSO TOLEDO	Data 03	0.933	ANDERSON DALMOLIN CATTELAN	Data 04	1.2
ARTHUR BOGACKI VERISSIMO	Data 05	0.98	BIANCA SABRINA BUBLITZ	Data 06	1.31
BRUNO DOS SANTOS UMPIERRE	Data 07	0.933	BRUNO PERUSSATTO	Data 08	1.07
CARLOS EDUARDO VELOZO CORREA	Data 09	0.466	CELSO MAIA DA SILVA NETO	Data 10	1.478
DAVI DE CASTRO MACHADO	Data 11	1.59	DIEGO RIBEIRO CHAVES	Data 12	0.562
DOUGLAS MAGALHAES SILVA	Data 13	1.67	ENZO HAHN VERONEZE	Data 14	0.831
FERNANDO KALIKOSQUE LAYDNER JUNIOR	Data 15	1.17	FERNANDO MARINO MELCHIOR	Data 16	0.418
GABRIEL ATARAO DENARDI	Data 17	0.843	GABRIEL DA SILVA FRANCA	Data 18	1.17
GABRIEL PORTO DE FREITAS	Data 19	1.64	GABRIEL SOUZA BAGGIO	Data 20	1.6
GABRIEL STIEGEMEIER	Data 21	1.78	GUILHERME BRIZZI	Data 22	0.821
GUILHERME MENEGHETTI EINLOFT	Data 23	1.03	IGOR GUIMARAES	Data 24	0.929
JAIME ANTONIO DANIEL FILHO	Data 25	1.1	JOAO PEDRO AZENHA RIGHI	Data 26	1.02
JOAO PEDRO DA SILVA MARQUES	Data 27	1.58	JOAO VITOR DA SILVA	Data 28	0.748
LARISSA RODRIGUES SILVEIRA	Data 29	1.62	LEANDRO BRUM DA SILVA LACORTE	Data 30	1.04
LEANDRO O. GALBARINO DO NASCIMENTO	Data 31	1.5	LUCAS XAVIER PAIRE	Data 32	1.67
LUIS FERNANDO DA CRUZ ANTUNES	Data 33	0.861	LUIS GUSTAVO WERLE TOZEVICH	Data 34	0.45
LUIS HENRIQUE SILVEIRA POZZEBON	Data 35	0.596	MATHIAS ECKERT RECKTENVALD	Data 36	0.41
MIGUEL BRONDANI	Data 37	1.06	MIGUEL MIRON SILVA	Data 38	1.35
PEDRO DE ANDRADE SANTOS	Data 39	0.506	RAFAELA DA ROSA SOARES	Data 40	1.33
TOBIAS VIERO DE OLIVEIRA	Data 41	0.757	VIVIANE DILKIN ENDLER	Data 42	0.8
WESLEY LOPES DE OLIVEIRA	Data 43	0.899			

TABELA II | PARTE 01/02

	Data 01		Data 02		Data 03		Data 04		Data 05		Data 06	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.16685	1.84601	0.19778	1.99133	0.175693	2.60196	0.18674	1.99175	0.193234	1.88387	0.171674	2.36004
2	0.343004	1.29404	0.394267	0.649714	0.348802	0.8886	0.353682	0.873784	0.353451	1.01419	0.358478	0.954791
3	0.505712	0.0251696	0.512318	0.000948577	0.548781	-0.0955136	0.534289	-0.0621949	0.563899	-0.0914764	0.50526	0.027663
4	0.738876	0.0677881	0.73689	0.0615512	0.723153	0.0266705	0.669258	-0.0511613	0.718398	0.027197	0.698935	-0.0139111
5	0.844666	0.257123	0.896797	0.237989	0.977692	0.29101	0.83618	0.210637	0.977932	0.279886	0.959712	0.330803
6	1.11868	0.234925	0.988253	0.271851	1.05229	0.161771	1.08326	0.216107	1.07897	0.224932	1.15077	0.347727
7	1.34982	2.45085	1.16666	0.353404	1.34823	2.33833	1.258	1.12401	1.2233	0.670747	1.22764	0.923144
8	1.43654	3.03161	1.57668	4.94699	1.34969	2.80585	1.4844	3.74141	1.54507	4.54957	1.34744	2.5488
9	1.67569	3.86358	1.74318	4.96514	1.63028	4.84164	1.6161	4.20832	1.62888	5.17413	1.60215	3.99809
10	1.91255	5.46121	1.65267	5.25835	1.97912	4.76005	1.93452	6.26879	1.89974	5.30574	1.78994	5.75135

	Data 07		Data 08		Data 09		Data 10		Data 11		Data 12	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.170574	1.95538	0.185127	2.21387	0.192692	2.16185	0.18298	1.73875	0.198057	1.74894	0.170475	2.16468
2	0.343547	0.975325	0.397215	0.456443	0.373353	0.703623	0.354001	1.16304	0.345867	1.27586	0.367034	0.825845
3	0.595031	-0.131471	0.512352	0.00110309	0.555951	-0.102417	0.503232	0.035614	0.537215	-0.0708575	0.550873	-0.066615
4	0.672028	-0.0482122	0.743575	0.0650015	0.700095	-0.0110756	0.708632	0.00480651	0.749615	0.0762969	0.798127	0.13522
5	0.847395	0.250371	0.852151	0.25797	0.820399	0.244729	0.950218	0.220686	0.832237	0.213195	0.969583	0.297575
6	1.10097	0.198441	1.18472	0.632726	1.12338	0.232499	1.13507	0.242296	1.1146	0.25394	1.0109	0.209714
7	1.26657	1.28664	1.21133	0.831312	1.20815	0.757545	1.15059	0.267534	1.18506	0.472748	1.29324	1.67638
8	1.40792	2.47978	1.36707	3.05502	1.31477	1.60944	1.4129	2.39221	1.35201	3.08483	1.52767	3.74498
9	1.54961	4.76804	1.70975	5.96692	1.5514	4.53903	1.5219	5.05237	1.49355	3.77289	1.62721	3.42445
10	1.99618	4.99768	1.955	4.93635	1.8848	6.52634	1.82383	6.51236	1.80485	4.82742	1.88191	4.28505

	Data 13		Data 14		Data 15		Data 16		Data 17		Data 18	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.186141	2.19202	0.186197	2.2668	0.187179	2.7187	0.168276	2.89782	0.179756	2.30495	0.187064	2.82297
2	0.384446	0.658207	0.398185	0.581417	0.395827	0.749429	0.362323	0.808027	0.347112	0.984841	0.371554	1.00839
3	0.513036	-0.00112004	0.505114	0.0210297	0.551455	-0.0835525	0.561218	-0.0815064	0.578884	-0.0960341	0.563828	-0.0935143
4	0.662491	-0.087314	0.764644	0.0872261	0.710616	0.00768122	0.798893	0.199081	0.692905	-0.0170697	0.759865	0.120377
5	0.928666	0.311972	0.936461	0.261834	0.936843	0.304345	0.949305	0.210435	0.902031	0.214135	0.992378	0.212007
6	1.0238	0.24897	1.09459	0.218021	1.01362	0.260355	1.10312	0.253319	1.01112	0.274476	1.07919	0.249608
7	1.18703	0.498794	1.19661	0.490755	1.16599	0.483134	1.33283	1.95404	1.38479	3.60903	1.25923	1.52451
8	1.42852	3.80754	1.53459	4.71865	1.35804	1.87773	1.48685	4.94934	1.33418	2.606	1.45466	3.64166
9	1.69215	4.10634	1.72542	4.70815	1.63485	3.80683	1.78933	4.73983	1.60435	5.17279	1.61861	5.83568
10	1.96777	5.8309	1.95935	4.71122	1.69015	5.22876	1.95673	7.06077	1.7102	4.71167	1.80648	4.23418

	Data 19		Data 20		Data 21		Data 22		Data 23		Data 24	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.166647	2.78153	0.173158	2.56941	0.168007	2.1264	0.187491	2.46108	0.164933	1.60799	0.165013	2.20825
2	0.342898	0.876663	0.387052	0.610646	0.344354	0.795982	0.341995	1.03229	0.391583	0.759897	0.35332	1.16737
3	0.496312	0.0387155	0.541873	-0.0663445	0.561105	-0.0876484	0.492241	0.0648063	0.542867	-0.0551896	0.512072	0.00177478
4	0.723691	0.0278969	0.783551	0.110715	0.787525	0.12903	0.703018	-0.0048001	0.697185	-0.0169766	0.760098	0.112065
5	0.913669	0.312067	0.847441	0.205614	0.845361	0.18453	0.946676	0.324966	0.957654	0.348586	0.951273	0.236567
6	1.10808	0.212712	0.999944	0.221273	1.0167	0.227449	1.18359	0.545253	1.04667	0.22125	1.10868	0.238927
7	1.39944	3.23247	1.24711	1.04203	1.16999	0.47212	1.3446	1.64073	1.23998	0.997246	1.29779	1.67127
8	1.59439	5.80694	1.43852	3.79514	1.36548	2.73481	1.40475	3.02898	1.32187	2.48547	1.41842	3.41201
9	1.75707	5.04981	1.77492	6.0786	1.63207	5.58112	1.53893	4.81502	1.66759	3.90465	1.51765	4.76609
10	1.99391	7.23596	1.66974	3.77974	1.879	5.85924	1.75721	4.27517	1.77276	3.97321	1.79942	4.66188

	Data 25		Data 26		Data 27		Data 28		Data 29		Data 30	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.17098	2.89875	0.190119	1.89223	0.180922	1.89825	0.19318	2.37663	0.184621	2.07939	0.175578	2.24114
2	0.336032	1.29729	0.340374	1.14133	0.359052	0.87245	0.370476	0.747464	0.363778	0.731033	0.382334	0.563595
3	0.578996	-0.12896	0.584615	-0.0896839	0.537296	-0.0604421	0.532763	-0.0603172	0.527319	-0.0282496	0.499899	0.0297206
4	0.798656	0.186687	0.763114	0.0976498	0.755139	0.0715725	0.718121	0.0259858	0.681353	-0.0476889	0.745711	0.0666124
5	0.960852	0.354029	0.96968	0.353377	0.870966	0.268127	0.925157	0.235358	0.909042	0.321599	0.845296	0.324232
6	1.0241	0.221959	1.14413	0.271851	1.14451	0.273929	1.1336	0.225324	1.07897	0.201969	1.01603	0.243318
7	1.38906	2.18595	1.15458	0.324559	1.25192	1.11525	1.24915	1.13186	1.22585	0.602466	1.21373	0.623653
8	1.49667	2.99836	1.37667	2.75412	1.48243	4.42853	1.336	1.60886	1.41777	3.08036	1.44026	2.56396
9	1.70333	3.9349	1.72125	4.78312	1.78393	4.67399	1.59864	3.92583	1.58336	4.23079	1.61544	5.32543
10	1.78477	4.07419	1.85792	6.682	1.93333	6.81067	1.97511	4.97159	1.90236	4.72143	1.95238	6.02341

TABELA II | PARTE 02/02

	Data 31		Data 32		Data 33		Data 34		Data 35		Data 36	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.167264	2.84831	0.18086	1.64832	0.176319	1.58702	0.194158	1.64328	0.168526	2.47068	0.196997	1.92943
2	0.375744	0.862072	0.338991	0.994142	0.366472	1.0075	0.362889	0.965476	0.357411	0.899439	0.384109	0.944914
3	0.573337	-0.131428	0.594431	-0.13861	0.573771	-0.111492	0.51609	-0.00909454	0.538672	-0.0747325	0.555638	-0.109156
4	0.68687	-0.0413058	0.700167	-0.00884923	0.703372	-0.00530248	0.750985	0.110775	0.762343	0.101636	0.692677	-0.0267848
5	0.93012	0.342375	0.947665	0.264026	0.847904	0.328716	0.823953	0.195544	0.935196	0.293561	0.967058	0.264622
6	1.13454	0.229793	1.08259	0.174269	1.02485	0.192916	1.11885	0.196496	1.13353	0.217503	1.03683	0.247216
7	1.28866	1.39694	1.15499	0.322003	1.19293	0.701331	1.26052	1.54719	1.15666	0.282537	1.26631	0.932804
8	1.50625	3.64033	1.35937	2.56192	1.58454	4.68225	1.41252	3.88756	1.3393	2.86655	1.35873	2.66976
9	1.56189	3.94954	1.77602	5.2004	1.792	4.19009	1.6866	3.40423	1.6912	3.48665	1.57811	3.46482
10	1.65422	5.34887	1.69412	3.90226	1.90807	6.77779	1.93677	4.57516	1.79631	5.96032	1.70068	3.77246

	Data 37		Data 38		Data 39		Data 40		Data 41		Data 42	
k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k	x_k	y_k
1	0.17787	2.28106	0.185309	1.62072	0.199602	2.74517	0.184156	2.31479	0.164635	2.86801	0.186732	2.81007
2	0.391536	0.825315	0.356146	1.03893	0.340649	0.924859	0.329805	1.14708	0.356935	1.04955	0.373393	0.960852
3	0.574627	-0.120376	0.544418	-0.0803628	0.51526	-0.0080687	0.570192	-0.103077	0.494406	0.0451641	0.511725	0.00269833
4	0.66615	-0.0484443	0.677295	-0.0476199	0.663879	-0.0837232	0.782329	0.16195	0.656759	-0.0693138	0.760667	0.132722
5	0.934389	0.230037	0.885766	0.305194	0.898268	0.328185	0.825797	0.170038	0.863576	0.271424	0.909423	0.351653
6	0.998697	0.204798	1.00101	0.229526	0.98705	0.265216	1.01405	0.239462	1.1995	0.726299	0.995465	0.316236
7	1.23109	0.963267	1.27559	1.56242	1.16109	0.30329	1.17819	0.55903	1.30549	1.47716	1.30283	1.88218
8	1.38294	2.97831	1.32865	1.78372	1.35284	2.73661	1.41811	2.62438	1.41065	2.62776	1.48527	3.52773
9	1.76298	5.47474	1.47801	3.0124	1.59888	4.01048	1.47982	3.67035	1.64759	3.60105	1.64519	4.82589
10	1.64709	5.07043	1.64025	4.29397	1.76554	3.97318	1.69621	4.16698	1.81665	6.25872	1.77729	4.6486

	Data 43	
k	x_k	y_k
1	0.197398	1.71201
2	0.361861	1.03482
3	0.562281	-0.115169
4	0.753226	0.110402
5	0.97451	0.22649
6	1.12354	0.306949
7	1.30405	2.09657
8	1.40504	2.57259
9	1.76016	4.07408
10	1.87148	5.37347

TABELA III

ALAN BESSAUER LENCINA CCB_MNC_AA03_AL01_ABL.pdf	ALEXANDRE CHAGAS BRITES CCB_MNC_AA03_AL02_ACB.pdf	ANA LILIAN ALFONSO TOLEDO CCB_MNC_AA03_AL03_ALAT.pdf
ANDERSON DALMOLIN CATTELAN CCB_MNC_AA03_AL04_ADC.pdf	ARTHUR BOGACKI VERISSIMO CCB_MNC_AA03_AL05_ABV.pdf	BIANCA SABRINA BUBLITZ CCB_MNC_AA03_AL06_BSB.pdf
BRUNO DOS SANTOS UMPIERRE CCB_MNC_AA03_AL07_BSU.pdf	BRUNO PERUSSATTO CCB_MNC_AA03_AL08_BP.pdf	CARLOS EDUARDO VELOZO CORREA CCB_MNC_AA03_AL09_CEVC.pdf
CELSO MAIA DA SILVA NETO CCB_MNC_AA03_AL10_CMSN.pdf	DAVI DE CASTRO MACHADO CCB_MNC_AA03_AL11_DCM.pdf	DIEGO RIBEIRO CHAVES CCB_MNC_AA03_AL12_DRC.pdf
DOUGLAS MAGALHAES SILVA CCB_MNC_AA03_AL13_DMS.pdf	ENZO HAHN VERONEZE CCB_MNC_AA03_AL14_EHV.pdf	FERNANDO K. LAYDNER JUNIOR CCB_MNC_AA03_AL15_FKLJ.pdf
FERNANDO MARINO MELCHIOR CCB_MNC_AA03_AL16_FMM.pdf	GABRIEL ATARAO DENARDI CCB_MNC_AA03_AL17_GAD.pdf	GABRIEL DA SILVA FRANCA CCB_MNC_AA03_AL18_GSF.pdf
GABRIEL PORTO DE FREITAS CCB_MNC_AA03_AL19_GPF.pdf	GABRIEL SOUZA BAGGIO CCB_MNC_AA03_AL20_GSB.pdf	GABRIEL STIEGEMEIER CCB_MNC_AA03_AL21_GS.pdf
GUILHERME BRIZZI CCB_MNC_AA03_AL22_GB.pdf	GUILHERME MENEGHETTI EINLOFT CCB_MNC_AA03_AL23_GME.pdf	IGOR GUIMARAES CCB_MNC_AA03_AL24_IG.pdf
JAIME ANTONIO DANIEL FILHO CCB_MNC_AA03_AL25_JADF.pdf	JOAO PEDRO AZENHA RIGHI CCB_MNC_AA03_AL26_JPAR.pdf	JOAO PEDRO DA SILVA MARQUES CCB_MNC_AA03_AL27_JPSM.pdf
JOAO VITOR DA SILVA CCB_MNC_AA03_AL28_JVS.pdf	LARISSA RODRIGUES SILVEIRA CCB_MNC_AA03_AL29_LRS.pdf	LEANDRO BRUM DA SILVA LACORTE CCB_MNC_AA03_AL30_LBSL.pdf
LEANDRO O. GALBARINO DO NASCIMENTO CCB_MNC_AA03_AL31_LOGN.pdf	LUCAS XAVIER PAIRE CCB_MNC_AA03_AL32_LXP.pdf	LUIS FERNANDO DA CRUZ ANTUNES CCB_MNC_AA03_AL33_LFCA.pdf
LUIS GUSTAVO WERLE TOZEVICH CCB_MNC_AA03_AL34_LGWT.pdf	LUIS HENRIQUE SILVEIRA POZZEBON CCB_MNC_AA03_AL35_LHSP.pdf	MATHIAS ECKERT RECKTENVALD CCB_MNC_AA03_AL36_MER.pdf
MIGUEL BRONDANI CCB_MNC_AA03_AL37_MB.pdf	MIGUEL MIRON SILVA CCB_MNC_AA03_AL38_MMS.pdf	PEDRO DE ANDRADE SANTOS CCB_MNC_AA03_AL39_PAS.pdf
RAFAELA DA ROSA SOARES CCB_MNC_AA03_AL40_RRS.pdf	TOBIAS VIERO DE OLIVEIRA CCB_MNC_AA03_AL41_TVO.pdf	VIVIANE DILKIN ENDLER CCB_MNC_AA03_AL42_VDE.pdf
WESLEY LOPES DE OLIVEIRA CCB_MNC_AA03_AL43_WLO.pdf		

EXEMPLO DE SOLUÇÃO

TABELA DE DIFERENÇAS DIVIDIDAS | $z = 1.03$

x	y	DD1	DD2	DD3	DD4	DD5	DD6	DD7	DD8	DD9
1.07118	0.197905	-0.346286	-5.7086	38.5684	-97.3048	507.112	736.947	-2678.61	-2635.38	-2311.97
0.87691	0.265178	1.54094	4.84833	5.8399	118.537	120.76	-875.738	-748.868	-619.234	-
0.740587	0.055113	3.80991	7.9471	79.3212	78.6877	-576.616	-472.866	-329.166	-	-
1.3449	2.35749	9.11017	67.9316	64.082	-459.095	-386.689	-294.638	-	-	-
1.40753	2.92806	19.4297	16.7955	-86.6573	-70.0997	-49.1029	-	-	-	-
1.49681	4.66274	4.97531	-6.23024	-11.7492	-10.7639	-	-	-	-	-
0.54692	-0.0632531	3.8761	7.3738	2.21893	-	-	-	-	-	-
1.67324	4.30248	2.34246	6.60209	-	-	-	-	-	-	-
0.338935	1.17692	-7.38972	-	-	-	-	-	-	-	-
0.199134	2.21001	-	-	-	-	-	-	-	-	-

ESTIMATIVAS | $f(z)$

k	$P_k(z)$	ER_k
0	0.197905	-
1	0.212165	0.0672121
2	0.248153	0.145025
3	0.177784	0.395812
4	0.121878	0.458703
5	0.0118818	9.25761
6	0.0865012	0.862641
7	-0.0445208	2.94294
8	0.0383976	2.15947
9	0.0886676	0.566949

APROXIMAÇÃO MAIS CONFIÁVEL: k = 2, $P_k(z) = 0.248153$

GRÁFICOS