

## module\_05.R

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```
#Initial Assignment
A <- matrix(1:100, nrow=10)
B <- matrix(1:1000, nrow=10)

#Finding determinants of matrices
det(A)

## [1] 0

#det(B)

#Finding inverse of matrices
#solve(A)
#solve(B)

#Both return errors.
#Matrix A is singular because it's determinant is zero, as shown below:
det(A)

## [1] 0

#Matrix B is not square, therefore it does not have an inverse
dim(B)

## [1] 10 100

#After clarification on Canvas
t(A)

##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
## [1,]    1    2    3    4    5    6    7    8    9   10
## [2,]   11   12   13   14   15   16   17   18   19   20
## [3,]   21   22   23   24   25   26   27   28   29   30
## [4,]   31   32   33   34   35   36   37   38   39   40
## [5,]   41   42   43   44   45   46   47   48   49   50
## [6,]   51   52   53   54   55   56   57   58   59   60
## [7,]   61   62   63   64   65   66   67   68   69   70
## [8,]   71   72   73   74   75   76   77   78   79   80
## [9,]   81   82   83   84   85   86   87   88   89   90
## [10,]  91   92   93   94   95   96   97   98   99  100

t(B)
```

##		[,1]	[,2]	[,3]	[,4]	[,5]	[,6]	[,7]	[,8]	[,9]	[,10]
##	[1,]	1	2	3	4	5	6	7	8	9	10
##	[2,]	11	12	13	14	15	16	17	18	19	20
##	[3,]	21	22	23	24	25	26	27	28	29	30
##	[4,]	31	32	33	34	35	36	37	38	39	40
##	[5,]	41	42	43	44	45	46	47	48	49	50
##	[6,]	51	52	53	54	55	56	57	58	59	60
##	[7,]	61	62	63	64	65	66	67	68	69	70
##	[8,]	71	72	73	74	75	76	77	78	79	80
##	[9,]	81	82	83	84	85	86	87	88	89	90
##	[10,]	91	92	93	94	95	96	97	98	99	100
##	[11,]	101	102	103	104	105	106	107	108	109	110
##	[12,]	111	112	113	114	115	116	117	118	119	120
##	[13,]	121	122	123	124	125	126	127	128	129	130
##	[14,]	131	132	133	134	135	136	137	138	139	140
##	[15,]	141	142	143	144	145	146	147	148	149	150
##	[16,]	151	152	153	154	155	156	157	158	159	160
##	[17,]	161	162	163	164	165	166	167	168	169	170
##	[18,]	171	172	173	174	175	176	177	178	179	180
##	[19,]	181	182	183	184	185	186	187	188	189	190
##	[20,]	191	192	193	194	195	196	197	198	199	200
##	[21,]	201	202	203	204	205	206	207	208	209	210
##	[22,]	211	212	213	214	215	216	217	218	219	220
##	[23,]	221	222	223	224	225	226	227	228	229	230
##	[24,]	231	232	233	234	235	236	237	238	239	240
##	[25,]	241	242	243	244	245	246	247	248	249	250
##	[26,]	251	252	253	254	255	256	257	258	259	260
##	[27,]	261	262	263	264	265	266	267	268	269	270
##	[28,]	271	272	273	274	275	276	277	278	279	280
##	[29,]	281	282	283	284	285	286	287	288	289	290
##	[30,]	291	292	293	294	295	296	297	298	299	300
##	[31,]	301	302	303	304	305	306	307	308	309	310
##	[32,]	311	312	313	314	315	316	317	318	319	320
##	[33,]	321	322	323	324	325	326	327	328	329	330
##	[34,]	331	332	333	334	335	336	337	338	339	340
##	[35,]	341	342	343	344	345	346	347	348	349	350
##	[36,]	351	352	353	354	355	356	357	358	359	360
##	[37,]	361	362	363	364	365	366	367	368	369	370
##	[38,]	371	372	373	374	375	376	377	378	379	380
##	[39,]	381	382	383	384	385	386	387	388	389	390
##	[40,]	391	392	393	394	395	396	397	398	399	400
##	[41,]	401	402	403	404	405	406	407	408	409	410
##	[42,]	411	412	413	414	415	416	417	418	419	420
##	[43,]	421	422	423	424	425	426	427	428	429	430
##	[44,]	431	432	433	434	435	436	437	438	439	440
##	[45,]	441	442	443	444	445	446	447	448	449	450
##	[46,]	451	452	453	454	455	456	457	458	459	460
##	[47,]	461	462	463	464	465	466	467	468	469	470
##	[48,]	471	472	473	474	475	476	477	478	479	480
##	[49,]	481	482	483	484	485	486	487	488	489	490

##	[50,]	491	492	493	494	495	496	497	498	499	500
##	[51,]	501	502	503	504	505	506	507	508	509	510
##	[52,]	511	512	513	514	515	516	517	518	519	520
##	[53,]	521	522	523	524	525	526	527	528	529	530
##	[54,]	531	532	533	534	535	536	537	538	539	540
##	[55,]	541	542	543	544	545	546	547	548	549	550
##	[56,]	551	552	553	554	555	556	557	558	559	560
##	[57,]	561	562	563	564	565	566	567	568	569	570
##	[58,]	571	572	573	574	575	576	577	578	579	580
##	[59,]	581	582	583	584	585	586	587	588	589	590
##	[60,]	591	592	593	594	595	596	597	598	599	600
##	[61,]	601	602	603	604	605	606	607	608	609	610
##	[62,]	611	612	613	614	615	616	617	618	619	620
##	[63,]	621	622	623	624	625	626	627	628	629	630
##	[64,]	631	632	633	634	635	636	637	638	639	640
##	[65,]	641	642	643	644	645	646	647	648	649	650
##	[66,]	651	652	653	654	655	656	657	658	659	660
##	[67,]	661	662	663	664	665	666	667	668	669	670
##	[68,]	671	672	673	674	675	676	677	678	679	680
##	[69,]	681	682	683	684	685	686	687	688	689	690
##	[70,]	691	692	693	694	695	696	697	698	699	700
##	[71,]	701	702	703	704	705	706	707	708	709	710
##	[72,]	711	712	713	714	715	716	717	718	719	720
##	[73,]	721	722	723	724	725	726	727	728	729	730
##	[74,]	731	732	733	734	735	736	737	738	739	740
##	[75,]	741	742	743	744	745	746	747	748	749	750
##	[76,]	751	752	753	754	755	756	757	758	759	760
##	[77,]	761	762	763	764	765	766	767	768	769	770
##	[78,]	771	772	773	774	775	776	777	778	779	780
##	[79,]	781	782	783	784	785	786	787	788	789	790
##	[80,]	791	792	793	794	795	796	797	798	799	800
##	[81,]	801	802	803	804	805	806	807	808	809	810
##	[82,]	811	812	813	814	815	816	817	818	819	820
##	[83,]	821	822	823	824	825	826	827	828	829	830
##	[84,]	831	832	833	834	835	836	837	838	839	840
##	[85,]	841	842	843	844	845	846	847	848	849	850
##	[86,]	851	852	853	854	855	856	857	858	859	860
##	[87,]	861	862	863	864	865	866	867	868	869	870
##	[88,]	871	872	873	874	875	876	877	878	879	880
##	[89,]	881	882	883	884	885	886	887	888	889	890
##	[90,]	891	892	893	894	895	896	897	898	899	900
##	[91,]	901	902	903	904	905	906	907	908	909	910
##	[92,]	911	912	913	914	915	916	917	918	919	920
##	[93,]	921	922	923	924	925	926	927	928	929	930
##	[94,]	931	932	933	934	935	936	937	938	939	940
##	[95,]	941	942	943	944	945	946	947	948	949	950
##	[96,]	951	952	953	954	955	956	957	958	959	960
##	[97,]	961	962	963	964	965	966	967	968	969	970
##	[98,]	971	972	973	974	975	976	977	978	979	980

```
## [99,] 981 982 983 984 985 986 987 988 989 990
## [100,] 991 992 993 994 995 996 997 998 999 1000
```

*#create two vectors (a and b)*

```
a <- c(10:19)
```

```
b <- c(100:1)
```

*#multiply matrices by vectors*

```
A%%a
```

```
##      [,1]
## [1,] 7495
## [2,] 7640
## [3,] 7785
## [4,] 7930
## [5,] 8075
## [6,] 8220
## [7,] 8365
## [8,] 8510
## [9,] 8655
## [10,] 8800
```

```
a%%A
```

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
## [1,]  880 2330 3780 5230 6680 8130 9580 11030 12480 13930
```

*B%%b #works because B has 100 columns and b has 100 values*

```
##      [,1]
## [1,] 1671550
## [2,] 1676600
## [3,] 1681650
## [4,] 1686700
## [5,] 1691750
## [6,] 1696800
## [7,] 1701850
## [8,] 1706900
## [9,] 1711950
## [10,] 1717000
```

*#b%%B #doesn't work because b has 100 values, and B only has ten rows*

*#Multiply matrices*

*A%%B #works because the number of columns in A is equal to the number of rows in B*

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10] [,11]
## [1,] 3355 7955 12555 17155 21755 26355 30955 35555 40155 44755 49355
##      53955
```

```

## [2,] 3410 8110 12810 17510 22210 26910 31610 36310 41010 45710 50410
55110
## [3,] 3465 8265 13065 17865 22665 27465 32265 37065 41865 46665 51465
56265
## [4,] 3520 8420 13320 18220 23120 28020 32920 37820 42720 47620 52520
57420
## [5,] 3575 8575 13575 18575 23575 28575 33575 38575 43575 48575 53575
58575
## [6,] 3630 8730 13830 18930 24030 29130 34230 39330 44430 49530 54630
59730
## [7,] 3685 8885 14085 19285 24485 29685 34885 40085 45285 50485 55685
60885
## [8,] 3740 9040 14340 19640 24940 30240 35540 40840 46140 51440 56740
62040
## [9,] 3795 9195 14595 19995 25395 30795 36195 41595 46995 52395 57795
63195
## [10,] 3850 9350 14850 20350 25850 31350 36850 42350 47850 53350 58850
64350
##      [,13] [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22]
[,23]
## [1,] 58555 63155 67755 72355 76955 81555 86155 90755 95355 99955
104555
## [2,] 59810 64510 69210 73910 78610 83310 88010 92710 97410 102110
106810
## [3,] 61065 65865 70665 75465 80265 85065 89865 94665 99465 104265
109065
## [4,] 62320 67220 72120 77020 81920 86820 91720 96620 101520 106420
111320
## [5,] 63575 68575 73575 78575 83575 88575 93575 98575 103575 108575
113575
## [6,] 64830 69930 75030 80130 85230 90330 95430 100530 105630 110730
115830
## [7,] 66085 71285 76485 81685 86885 92085 97285 102485 107685 112885
118085
## [8,] 67340 72640 77940 83240 88540 93840 99140 104440 109740 115040
120340
## [9,] 68595 73995 79395 84795 90195 95595 100995 106395 111795 117195
122595
## [10,] 69850 75350 80850 86350 91850 97350 102850 108350 113850 119350
124850
##      [,24] [,25] [,26] [,27] [,28] [,29] [,30] [,31] [,32]
[,33]
## [1,] 109155 113755 118355 122955 127555 132155 136755 141355 145955
150555
## [2,] 111510 116210 120910 125610 130310 135010 139710 144410 149110
153810
## [3,] 113865 118665 123465 128265 133065 137865 142665 147465 152265
157065
## [4,] 116220 121120 126020 130920 135820 140720 145620 150520 155420
160320

```

```
## [5,] 118575 123575 128575 133575 138575 143575 148575 153575 158575
163575
## [6,] 120930 126030 131130 136230 141330 146430 151530 156630 161730
166830
## [7,] 123285 128485 133685 138885 144085 149285 154485 159685 164885
170085
## [8,] 125640 130940 136240 141540 146840 152140 157440 162740 168040
173340
## [9,] 127995 133395 138795 144195 149595 154995 160395 165795 171195
176595
## [10,] 130350 135850 141350 146850 152350 157850 163350 168850 174350
179850
##      [,34] [,35] [,36] [,37] [,38] [,39] [,40] [,41] [,42]
[,43]
## [1,] 155155 159755 164355 168955 173555 178155 182755 187355 191955
196555
## [2,] 158510 163210 167910 172610 177310 182010 186710 191410 196110
200810
## [3,] 161865 166665 171465 176265 181065 185865 190665 195465 200265
205065
## [4,] 165220 170120 175020 179920 184820 189720 194620 199520 204420
209320
## [5,] 168575 173575 178575 183575 188575 193575 198575 203575 208575
213575
## [6,] 171930 177030 182130 187230 192330 197430 202530 207630 212730
217830
## [7,] 175285 180485 185685 190885 196085 201285 206485 211685 216885
222085
## [8,] 178640 183940 189240 194540 199840 205140 210440 215740 221040
226340
## [9,] 181995 187395 192795 198195 203595 208995 214395 219795 225195
230595
## [10,] 185350 190850 196350 201850 207350 212850 218350 223850 229350
234850
##      [,44] [,45] [,46] [,47] [,48] [,49] [,50] [,51] [,52]
[,53]
## [1,] 201155 205755 210355 214955 219555 224155 228755 233355 237955
242555
## [2,] 205510 210210 214910 219610 224310 229010 233710 238410 243110
247810
## [3,] 209865 214665 219465 224265 229065 233865 238665 243465 248265
253065
## [4,] 214220 219120 224020 228920 233820 238720 243620 248520 253420
258320
## [5,] 218575 223575 228575 233575 238575 243575 248575 253575 258575
263575
## [6,] 222930 228030 233130 238230 243330 248430 253530 258630 263730
268830
## [7,] 227285 232485 237685 242885 248085 253285 258485 263685 268885
274085
```

```
## [8,] 231640 236940 242240 247540 252840 258140 263440 268740 274040
279340
## [9,] 235995 241395 246795 252195 257595 262995 268395 273795 279195
284595
## [10,] 240350 245850 251350 256850 262350 267850 273350 278850 284350
289850
##      [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61] [,62]
[,63]
## [1,] 247155 251755 256355 260955 265555 270155 274755 279355 283955
288555
## [2,] 252510 257210 261910 266610 271310 276010 280710 285410 290110
294810
## [3,] 257865 262665 267465 272265 277065 281865 286665 291465 296265
301065
## [4,] 263220 268120 273020 277920 282820 287720 292620 297520 302420
307320
## [5,] 268575 273575 278575 283575 288575 293575 298575 303575 308575
313575
## [6,] 273930 279030 284130 289230 294330 299430 304530 309630 314730
319830
## [7,] 279285 284485 289685 294885 300085 305285 310485 315685 320885
326085
## [8,] 284640 289940 295240 300540 305840 311140 316440 321740 327040
332340
## [9,] 289995 295395 300795 306195 311595 316995 322395 327795 333195
338595
## [10,] 295350 300850 306350 311850 317350 322850 328350 333850 339350
344850
##      [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72]
[,73]
## [1,] 293155 297755 302355 306955 311555 316155 320755 325355 329955
334555
## [2,] 299510 304210 308910 313610 318310 323010 327710 332410 337110
341810
## [3,] 305865 310665 315465 320265 325065 329865 334665 339465 344265
349065
## [4,] 312220 317120 322020 326920 331820 336720 341620 346520 351420
356320
## [5,] 318575 323575 328575 333575 338575 343575 348575 353575 358575
363575
## [6,] 324930 330030 335130 340230 345330 350430 355530 360630 365730
370830
## [7,] 331285 336485 341685 346885 352085 357285 362485 367685 372885
378085
## [8,] 337640 342940 348240 353540 358840 364140 369440 374740 380040
385340
## [9,] 343995 349395 354795 360195 365595 370995 376395 381795 387195
392595
## [10,] 350350 355850 361350 366850 372350 377850 383350 388850 394350
399850
```

```

##      [,74] [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82]
[,83]
## [1,] 339155 343755 348355 352955 357555 362155 366755 371355 375955
380555
## [2,] 346510 351210 355910 360610 365310 370010 374710 379410 384110
388810
## [3,] 353865 358665 363465 368265 373065 377865 382665 387465 392265
397065
## [4,] 361220 366120 371020 375920 380820 385720 390620 395520 400420
405320
## [5,] 368575 373575 378575 383575 388575 393575 398575 403575 408575
413575
## [6,] 375930 381030 386130 391230 396330 401430 406530 411630 416730
421830
## [7,] 383285 388485 393685 398885 404085 409285 414485 419685 424885
430085
## [8,] 390640 395940 401240 406540 411840 417140 422440 427740 433040
438340
## [9,] 397995 403395 408795 414195 419595 424995 430395 435795 441195
446595
## [10,] 405350 410850 416350 421850 427350 432850 438350 443850 449350
454850
##      [,84] [,85] [,86] [,87] [,88] [,89] [,90] [,91] [,92]
[,93]
## [1,] 385155 389755 394355 398955 403555 408155 412755 417355 421955
426555
## [2,] 393510 398210 402910 407610 412310 417010 421710 426410 431110
435810
## [3,] 401865 406665 411465 416265 421065 425865 430665 435465 440265
445065
## [4,] 410220 415120 420020 424920 429820 434720 439620 444520 449420
454320
## [5,] 418575 423575 428575 433575 438575 443575 448575 453575 458575
463575
## [6,] 426930 432030 437130 442230 447330 452430 457530 462630 467730
472830
## [7,] 435285 440485 445685 450885 456085 461285 466485 471685 476885
482085
## [8,] 443640 448940 454240 459540 464840 470140 475440 480740 486040
491340
## [9,] 451995 457395 462795 468195 473595 478995 484395 489795 495195
500595
## [10,] 460350 465850 471350 476850 482350 487850 493350 498850 504350
509850
##      [,94] [,95] [,96] [,97] [,98] [,99] [,100]
## [1,] 431155 435755 440355 444955 449555 454155 458755
## [2,] 440510 445210 449910 454610 459310 464010 468710
## [3,] 449865 454665 459465 464265 469065 473865 478665
## [4,] 459220 464120 469020 473920 478820 483720 488620
## [5,] 468575 473575 478575 483575 488575 493575 498575

```



```
## [6,] 477930 483030 488130 493230 498330 503430 508530
## [7,] 487285 492485 497685 502885 508085 513285 518485
## [8,] 496640 501940 507240 512540 517840 523140 528440
## [9,] 505995 511395 516795 522195 527595 532995 538395
## [10,] 515350 520850 526350 531850 537350 542850 548350
```

*#B%%A #doesn't work because the number of columns in B is not equal to the number of rows in A*

*#Inverse a matrix*

```
S=matrix(2:5, nrow=2)
```

```
det(S)
```

```
## [1] -2
```

```
solve(S)
```

```
##      [,1] [,2]
```

```
## [1,] -2.5  2
```

```
## [2,]  1.5 -1
```