MET 4501 Spring 2025: In-Class Quiz 6 Name: SOLUTION

INSTRUCTIONS:

This quiz is open-book and open-note, and you may work with your classmates. Please answer all questions and show all of your work.

GIVEN:

We are considering two different ball bearings for a design. One is bearing number 361203R, provided by SKF, which rates its bearings for 10^6 cycles. The other is bearing number 6303, provided by Timken, which rates its bearings for 300 hours at 500 rev/min.

FIND:

(a) Fill in the table below using the attached catalog pages.

Manufacturer	Bearing No.	Basic Dynamic Load Rating (C_{10})	Rating System (Life Rating)
Timken	6303	13.60 kN	300 hrs @ 500 rpm
SKF	361203 R	8.84 kN	10^6 cycles

(b) Determine which of these two bearings can carry the higher load.

TIMKEN: $a_1 F_R L_R^{1/a} = F_D L_D^{1/a}$

$a = 3$ FOR BALL BEARINGS

$$a_1 (13.60\ \text{kN}) \underbrace{\left(60 \tfrac{\text{min}}{\text{hr}} \cdot 300\ \text{hr} \cdot 500\ \text{rpm}\right)}_{= 9 \times 10^6\ \text{cycles}}^{1/3} = F_D L_D^{1/3}$$

$$F_{D,\text{TIMKEN}} = \frac{2829\, a_1}{L_D^{1/3}} \quad [\text{kN}]$$

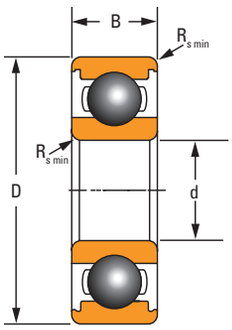
SKF: $a_1 F_R L_R^{1/a} = F_D L_D^{1/a}$

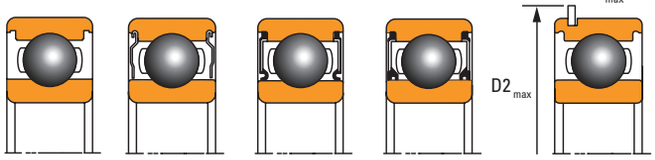
$$a_1 (8.84\ \text{kN})(10^6)^{1/3} = F_D L_D^{1/3}$$

$$F_{D,\text{SKF}} = \frac{884\, a_1}{L_D^{1/3}} \quad [\text{kN}]$$

$F_{D,\text{TIMKEN}} > F_{D,\text{SKF}} \Rightarrow$ THE TIMKEN BEARING CAN CARRY A HIGHER LOAD, IF RELIABILITY AND DESIRED LIFE ARE HELD CONSTANT.

STANDARD 6000 SERIES





OPEN | SHIELDS One = Z Two = ZZ | CONTACT SEALS One = RS Two = 2RS | NON-CONTACT SEALS Two = 2RZ | SNAP RING NR

TABLE 1. 6000 SERIES

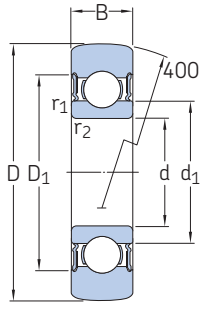
Bearing No.							Boundary Dimensions						Load Ratings		Thermal Reference Speed		Weight
Description	Features						Bore	O.D.	Width	Radius			Dynamic	Static	Grease	Oil	
							d	D	B	$R_{s\,min}$	$D2_{max}$	f_{max}	C_r	C_{0r}			
	Z	ZZ	RS	2RS	2RZ	NR	mm	mm	mm	mm	mm	mm	kN	kN	RPM	RPM	kg
6000	•	•	•	•	•	•	10	26	8	0.3	29.2	0.70	4.60	2.00	26000	38000	0.020
6200	•	•	•	•		•	10	30	9	0.6	34.7	1.12	5.10	2.40	22000	32000	0.030
6300	•	•	•	•		•	10	35	11	0.6	39.7	1.12	8.10	3.50	20000	29000	0.050
6001	•	•	•	•		•	12	28	8	0.3	30.8	0.85	5.10	2.40	23000	33000	0.020
6201	•	•	•	•	•	•	12	32	10	0.6	36.7	1.12	6.80	3.00	21000	30000	0.040
6301	•	•	•	•		•	12	37	12	1.0	41.3	1.12	9.70	4.20	19000	27000	0.060
6002	•	•	•	•		•	15	32	9	0.3	36.7	1.12	5.60	2.80	20000	30000	0.030
6202	•	•	•	•	•	•	15	35	11	0.6	39.7	1.12	7.60	3.70	19000	28000	0.050
6302	•	•	•	•	•	•	15	42	13	1.0	46.3	1.12	11.40	5.40	16000	24000	0.080
6003	•	•	•	•		•	17	35	10	0.3	39.7	1.12	6.00	3.30	19000	28000	0.040
6203	•	•	•	•	•	•	17	40	12	0.6	44.6	1.12	9.60	4.80	17000	25000	0.070
6303	•	•	•	•	•	•	17	47	14	1.0	52.7	1.12	13.60	6.60	15000	22000	0.120
6004	•	•	•	•	•	•	20	42	12	0.6	46.3	1.12	9.40	5.00	17000	25000	0.070
6204	•	•	•	•	•	•	20	47	14	1.0	52.7	1.12	12.80	6.60	15000	22000	0.100
6304	•	•	•	•	•	•	20	52	15	1.1	57.9	1.12	15.90	7.80	13000	20000	0.140
6005	•	•	•	•	•	•	25	47	12	0.6	52.7	1.12	10.10	5.80	14000	21000	0.080
6205	•	•	•	•	•	•	25	52	15	1.0	57.9	1.12	14.00	7.90	14000	20000	0.130
6305	•	•	•	•		•	25	62	17	1.1	67.7	1.70	20.60	11.20	12000	17000	0.220
6405						•	25	80	21	1.5	86.6	1.70	36.10	18.80	10000	15000	0.530
6006	•	•	•	•	•	•	30	55	13	1.0	60.7	1.12	13.20	8.30	12000	18000	0.110
6206	•	•	•	•	•	•	30	62	16	1.0	67.7	1.70	19.50	11.30	11000	16000	0.200
6306	•	•	•	•	•	•	30	72	19	1.1	78.6	1.70	26.60	15.00	10000	15000	0.350
6406						•	30	90	23	1.5	96.5	2.46	47.30	24.50	9300	13000	0.740
6007	•	•	•	•	•	•	35	62	14	1.0	67.7	1.70	15.90	10.30	11000	16000	0.150
6207	•	•	•	•	•	•	35	72	17	1.1	78.6	1.70	25.70	15.30	10000	14000	0.290
6307	•	•	•	•	•	•	35	80	21	1.5	86.6	1.70	33.40	19.20	9300	13000	0.450
6307MB							35	80	21	1.5	-	-	33.40	19.20	9300	13000	0.550
6407							35	100	25	1.5	-	-	55.50	29.40	8500	12000	0.950
6008	•	•	•	•	•	•	40	68	15	1.0	74.6	1.70	16.80	11.50	10000	15000	0.190
6208	•	•	•	•	•	•	40	80	18	1.1	86.6	1.70	29.50	18.10	8800	13000	0.370
6308	•	•	•	•	•	•	40	90	23	1.5	96.5	2.46	40.70	24.00	8500	12000	0.640
6408						•	40	110	27	2.0	116.6	2.46	63.70	34.60	7800	11000	1.250
6009	•	•	•	•	•	•	45	75	16	1.0	81.6	1.70	19.90	14.00	9200	13000	0.230
6209	•	•	•	•		•	45	85	19	1.1	91.6	1.70	31.20	20.30	8200	12000	0.420
6309	•	•	•	•	•	•	45	100	25	1.5	106.5	2.46	48.80	29.30	7800	11000	0.840
6309MB				•			45	100	25	1.5	-	-	48.80	29.30	7800	11000	1.025
6409						•	45	120	29	2.0	129.7	2.82	77.20	45.20	7200	10000	1.550
6010	•	•	•	•	•	•	50	80	16	1.0	86.6	1.70	21.80	16.50	8300	12000	0.250
6210	•	•	•	•	•	•	50	90	20	1.1	96.5	2.46	35.00	23.20	7700	11000	0.460
6310	•	•	•	•		•	50	110	27	2.0	116.6	2.46	57.50	35.30	7200	10000	1.050
6310MB							50	110	27	2.0	-	-	57.50	35.30	7200	10000	1.260
6410							50	130	31	2.1	-	-	83.10	49.40	6800	9700	1.900
6011	•	•	•	•		•	55	90	18	1.1	96.5	2.46	28.30	22.40	7800	11000	0.360
6211	•	•	•	•		•	55	100	21	1.5	106.5	2.46	43.40	29.20	7000	10000	0.610

Speed ratings are for open bearings. Use 50 to 60 percent of the published speed ratings for bearings with contact seals.

Continued on next page.

14.1 Single row cam rollers

D **32 – 80** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Maximum radial loads dynamic	static	Limiting speed	Mass	Designation
D	d	B	C	C_0	P_u	F_r max.	F_{0r} max.			
mm			kN		kN	kN		r/min	kg	–
32	10	9	4,68	2,04	0,085	3,45	5	12 000	0,04	▸ **361200 R**
35	12	10	6,24	2,6	0,11	3,35	4,75	11 000	0,051	▸ **361201 R**
40	15	11	7,02	3,2	0,137	5,1	7,35	9 500	0,072	▸ **361202 R**
47	17	12	8,84	4,25	0,18	8,15	11,6	8 500	0,11	▸ **361203 R**
52	20	14	11,4	5,5	0,232	7,5	10,6	7 000	0,15	▸ **361204 R**
62	25	15	13	6,8	0,29	12,9	18,6	6 300	0,24	▸ **361205 R**
72	30	16	17,4	9,5	0,4	14,6	20,8	5 300	0,34	▸ **361206 R**
80	35	17	22,1	11,8	0,5	12,9	18,3	4 500	0,42	▸ **361207 R**

▸ Popular item