

360° MOMENTUM

Find the Speeds of vehicles colliding at an angle using Momentum.

CASE NUMBER: A Sample Recon Case

8/5/2018

$$V2 = \frac{W1 \times V3 \times \sin\Theta}{W2 \times \sin\Psi} + \frac{V4 \times \sin\Phi}{\sin\Psi}$$

V1 = The Speed of Veh 1 in MPH.
V2 = The Speed of Veh 2 in MPH.
V3 = The Spd After Impact, Veh 1.
V4 = The Spd After Impact, Veh 2.

$$V2 = \frac{4000.0000 \times 17.6600 \times 0.3115}{3931.0000 \times 0.4197} + \frac{19.0600 \times 0.6068}{0.4197}$$

$$V2 = \frac{22004.3600}{1649.8407} + \frac{11.5656}{0.4197}$$

W1 = The Wt of Veh 1 in Pounds.
W2 = The Wt of Veh 2 in Pounds.
Θ = The Departure Angle(°), Veh 1.
Φ = The Departure Angle(°), Veh 2.
Ψ = The Approach Angle(°), Veh 2.

V2 = 13.3372 + 27.5568

V2 = 40.8940

$$V1 = V3 \times \cos\Theta + \frac{W2 \times V4 \times \cos\Phi}{W1} - \frac{W2 \times V2 \times \cos\Psi}{W1}$$

$$V1 = 17.6600 \times 0.9502 + \frac{3931.0000 \times 19.0600 \times 0.7948}{4000.0000} - \frac{3931.0000 \times 40.8940 \times -0.9076}{4000.0000}$$

$$V1 = 17.6600 \times 0.9502 + \frac{59550.2787}{4000.0000} - \frac{-145900.6153}{4000.0000}$$

V1 = 16.7805 + 14.8875 - -36.4751

V1 = 68.1431

Formula Inputs:

The Wt of Veh 1 (lbs) is: 4000.0000
 The After Impact Speed of Veh 1 is: 17.6600
 The Depart Angle (°) Veh 1 is: 18.1500
 The Wt of Veh 2 (lbs) is: 3931.0000
 The After Impact Speed of Veh 2 is: 19.0600
 The Depart Angle (°) Veh 2 is: 37.3600
 The Angle of Approach (°) is: 155.1800

Formula Results:

The Spd of Veh 1 in MPH is: 68.1431
 The Vel of Veh 1 in FPS is: 99.9432
 The Spd of Veh 2 in MPH is: 40.8940
 The Vel of Veh 2 in FPS is: 59.9778
 ΔV1 (mph/kph) is: 51.6555
 ΔV2 (mph/kph) is: 52.5654
 V1 Mean G Force (G's) is: 23.5283
 V2 Mean G Force (G's) is: 23.9428

You can put text you want/need down here in the footer section.

Energy Absorbed (ft-lbs/kg-m) is: 750572.9828

Vector Sum Analysis Info:

<u>ITEM</u>	<u>MPH-LB</u>
W1V1	272572.4000
W2V2	160754.3140
W1V1+W2V2*	143519.9764
V1 PDOF/ Δ P	206622.2147
W1V3	70640.0000
W2V4	74924.8600
W1V3+W2V4*	143526.0368
V2 PDOF/ Δ P	206634.7119

* Note that these are VECTORAL additions.

PDOF1 = 173.8866° (E to G = 6.1134°)

PDOF2 = 353.8844° (F to H = 18.7044°)

Vector Sum Analysis Diagram:

<u>INCHES</u>	<u>DEGREES</u>
3.0000	0.00°
1.7693	155.1800°
1.5796	28.0457°
2.2741	173.8866°
0.7774	18.1500°
0.8246	37.3600°
1.5796	28.0457°
2.2742	353.8844°

Scale of Diagram: 1 inch = 90857.4666 mph-lb.

Calculation Notes:

adgsdfbsdfb

sfdb

sgb

strgh

erth

eryj

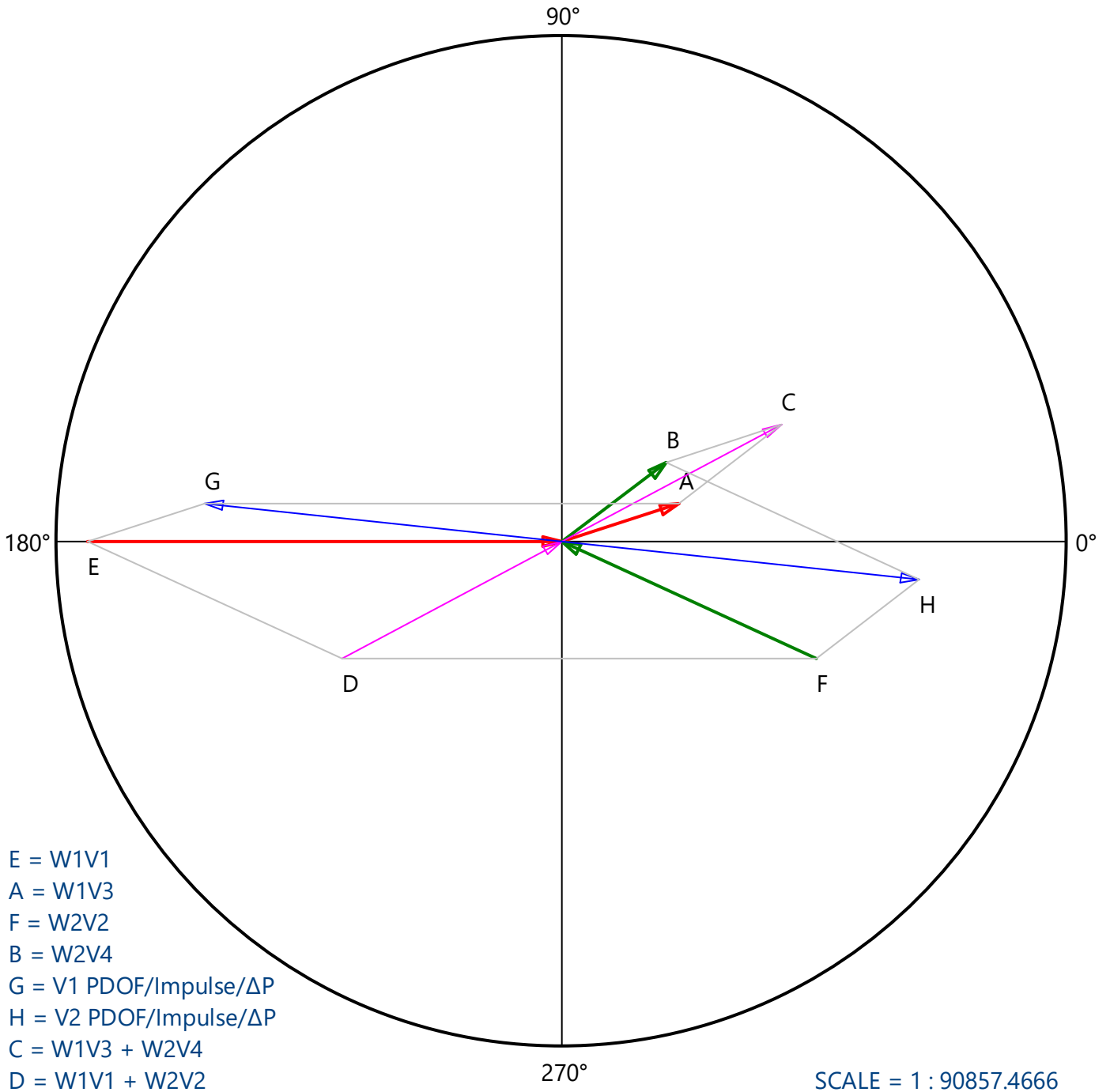
sfb

sdfg

werg

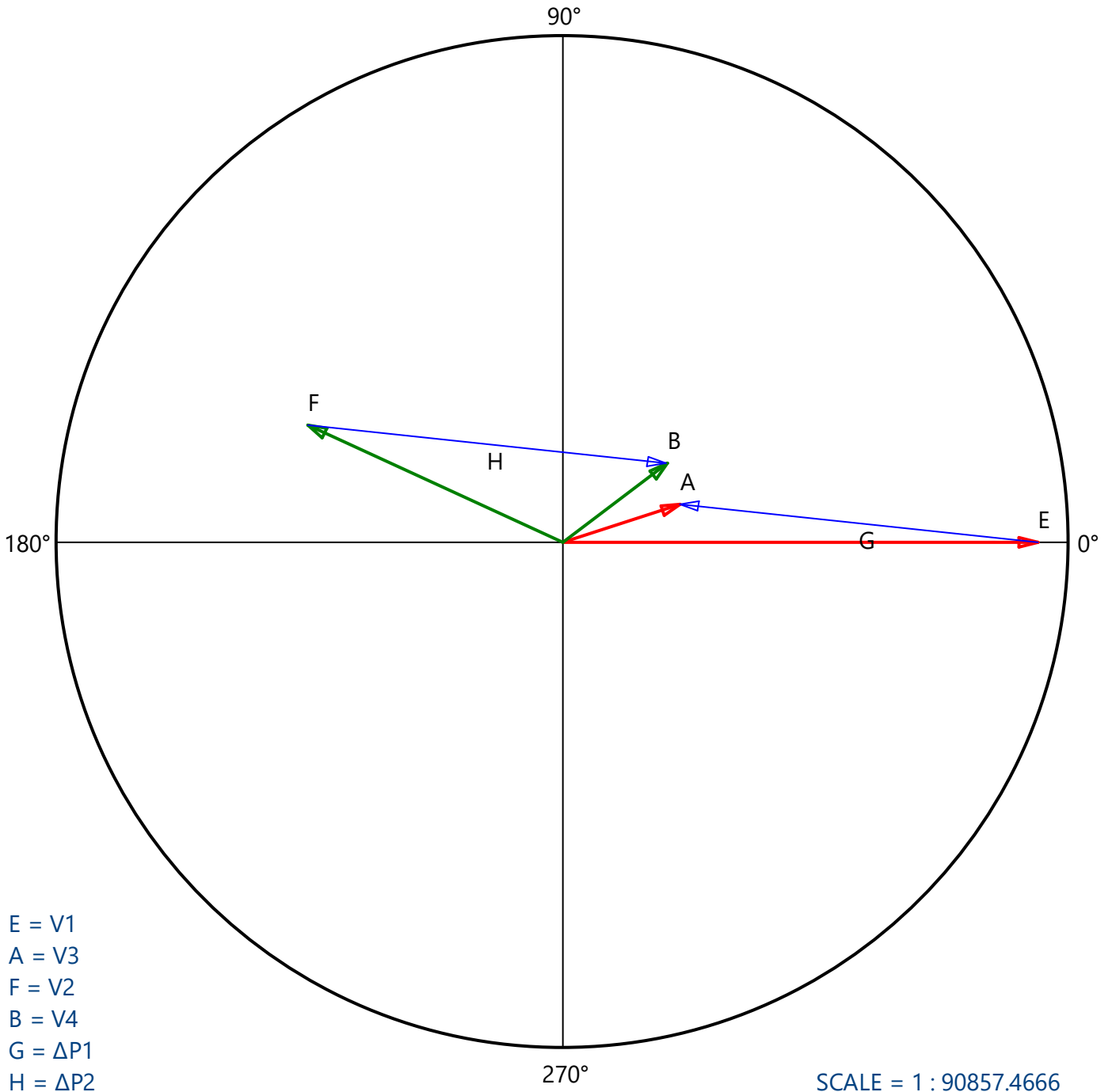
You can put text you want/need down here in the footer section.

Vector Sum Analysis (Type A):



You can put text you want/need down here in the footer section.

Vector Sum Analysis (Type B):



You can put text you want/need down here in the footer section.

Incrementation Results

<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>	<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>	<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>
3850.0000	40.3939	69.6809	3900.0000	40.5606	69.1552	3950.0000	40.7273	68.6427
3851.0000	40.3972	69.6701	3901.0000	40.5639	69.1447	3951.0000	40.7306	68.6326
3852.0000	40.4005	69.6595	3902.0000	40.5673	69.1344	3952.0000	40.7340	68.6225
3853.0000	40.4039	69.6489	3903.0000	40.5706	69.1240	3953.0000	40.7373	68.6124
3854.0000	40.4072	69.6382	3904.0000	40.5739	69.1136	3954.0000	40.7406	68.6022
3855.0000	40.4105	69.6276	3905.0000	40.5773	69.1033	3955.0000	40.7440	68.5922
3856.0000	40.4139	69.6170	3906.0000	40.5806	69.0929	3956.0000	40.7473	68.5821
3857.0000	40.4172	69.6064	3907.0000	40.5839	69.0826	3957.0000	40.7506	68.5720
3858.0000	40.4205	69.5958	3908.0000	40.5873	69.0723	3958.0000	40.7540	68.5620
3859.0000	40.4239	69.5852	3909.0000	40.5906	69.0619	3959.0000	40.7573	68.5519
3860.0000	40.4272	69.5746	3910.0000	40.5939	69.0516	3960.0000	40.7606	68.5418
3861.0000	40.4305	69.5639	3911.0000	40.5973	69.0413	3961.0000	40.7640	68.5317
3862.0000	40.4339	69.5534	3912.0000	40.6006	69.0309	3962.0000	40.7673	68.5216
3863.0000	40.4372	69.5428	3913.0000	40.6039	69.0206	3963.0000	40.7706	68.5116
3864.0000	40.4405	69.5322	3914.0000	40.6073	69.0103	3964.0000	40.7740	68.5016
3865.0000	40.4439	69.5217	3915.0000	40.6106	69.0000	3965.0000	40.7773	68.4915
3866.0000	40.4472	69.5110	3916.0000	40.6139	68.9897	3966.0000	40.7806	68.4814
3867.0000	40.4505	69.5005	3917.0000	40.6173	68.9795	3967.0000	40.7840	68.4715
3868.0000	40.4539	69.4900	3918.0000	40.6206	68.9691	3968.0000	40.7873	68.4614
3869.0000	40.4572	69.4794	3919.0000	40.6239	68.9588	3969.0000	40.7906	68.4513
3870.0000	40.4606	69.4689	3920.0000	40.6273	68.9486	3970.0000	40.7940	68.4414
3871.0000	40.4639	69.4583	3921.0000	40.6306	68.9383	3971.0000	40.7973	68.4313
3872.0000	40.4672	69.4478	3922.0000	40.6339	68.9280	3972.0000	40.8007	68.4214
3873.0000	40.4706	69.4373	3923.0000	40.6373	68.9178	3973.0000	40.8040	68.4114
3874.0000	40.4739	69.4267	3924.0000	40.6406	68.9076	3974.0000	40.8073	68.4013
3875.0000	40.4772	69.4163	3925.0000	40.6439	68.8972	3975.0000	40.8107	68.3914
3876.0000	40.4806	69.4058	3926.0000	40.6473	68.8870	3976.0000	40.8140	68.3814
3877.0000	40.4839	69.3952	3927.0000	40.6506	68.8768	3977.0000	40.8173	68.3713
3878.0000	40.4872	69.3847	3928.0000	40.6539	68.8665	3978.0000	40.8207	68.3615
3879.0000	40.4906	69.3743	3929.0000	40.6573	68.8563	3979.0000	40.8240	68.3514
3880.0000	40.4939	69.3638	3930.0000	40.6606	68.8461	3980.0000	40.8273	68.3414
3881.0000	40.4972	69.3532	3931.0000	40.6639	68.8358	3981.0000	40.8307	68.3316
3882.0000	40.5006	69.3429	3932.0000	40.6673	68.8257	3982.0000	40.8340	68.3215
3883.0000	40.5039	69.3323	3933.0000	40.6706	68.8154	3983.0000	40.8373	68.3116
3884.0000	40.5072	69.3219	3934.0000	40.6739	68.8052	3984.0000	40.8407	68.3017
3885.0000	40.5106	69.3114	3935.0000	40.6773	68.7950	3985.0000	40.8440	68.2917
3886.0000	40.5139	69.3010	3936.0000	40.6806	68.7849	3986.0000	40.8473	68.2817
3887.0000	40.5172	69.2904	3937.0000	40.6840	68.7748	3987.0000	40.8507	68.2719
3888.0000	40.5206	69.2801	3938.0000	40.6873	68.7645	3988.0000	40.8540	68.2619
3889.0000	40.5239	69.2695	3939.0000	40.6906	68.7543	3989.0000	40.8573	68.2520
3890.0000	40.5272	69.2591	3940.0000	40.6940	68.7442	3990.0000	40.8607	68.2420
3891.0000	40.5306	69.2488	3941.0000	40.6973	68.7340	3991.0000	40.8640	68.2321
3892.0000	40.5339	69.2383	3942.0000	40.7006	68.7238	3992.0000	40.8673	68.2222
3893.0000	40.5372	69.2278	3943.0000	40.7040	68.7137	3993.0000	40.8707	68.2123
3894.0000	40.5406	69.2175	3944.0000	40.7073	68.7035	3994.0000	40.8740	68.2024
3895.0000	40.5439	69.2071	3945.0000	40.7106	68.6934	3995.0000	40.8773	68.1925
3896.0000	40.5472	69.1966	3946.0000	40.7140	68.6833	3996.0000	40.8807	68.1826
3897.0000	40.5506	69.1863	3947.0000	40.7173	68.6731	3997.0000	40.8840	68.1728
3898.0000	40.5539	69.1759	3948.0000	40.7206	68.6629	3998.0000	40.8873	68.1629
3899.0000	40.5572	69.1655	3949.0000	40.7240	68.6529	3999.0000	40.8907	68.1530

You can put text you want/need down here in the footer section.

Incrementation Results

<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>	<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>	<u>V1 Wt</u>	<u>V2 Spd</u>	<u>V1 Spd</u>
4000.0000	40.8940	68.1431	4050.0000	41.0607	67.6558	4100.0000	41.2274	67.1805
4001.0000	40.8973	68.1332	4051.0000	41.0641	67.6463	4101.0000	41.2308	67.1712
4002.0000	40.9007	68.1234	4052.0000	41.0674	67.6367	4102.0000	41.2341	67.1617
4003.0000	40.9040	68.1136	4053.0000	41.0707	67.6270	4103.0000	41.2374	67.1524
4004.0000	40.9074	68.1037	4054.0000	41.0741	67.6174	4104.0000	41.2408	67.1431
4005.0000	40.9107	68.0938	4055.0000	41.0774	67.6078	4105.0000	41.2441	67.1336
4006.0000	40.9140	68.0840	4056.0000	41.0807	67.5982	4106.0000	41.2475	67.1243
4007.0000	40.9174	68.0742	4057.0000	41.0841	67.5887	4107.0000	41.2508	67.1150
4008.0000	40.9207	68.0644	4058.0000	41.0874	67.5790	4108.0000	41.2541	67.1055
4009.0000	40.9240	68.0545	4059.0000	41.0907	67.5694	4109.0000	41.2575	67.0962
4010.0000	40.9274	68.0448	4060.0000	41.0941	67.5599	4110.0000	41.2608	67.0869
4011.0000	40.9307	68.0349	4061.0000	41.0974	67.5503	4111.0000	41.2641	67.0774
4012.0000	40.9340	68.0251	4062.0000	41.1007	67.5407	4112.0000	41.2675	67.0682
4013.0000	40.9374	68.0153	4063.0000	41.1041	67.5312	4113.0000	41.2708	67.0588
4014.0000	40.9407	68.0055	4064.0000	41.1074	67.5216	4114.0000	41.2741	67.0495
4015.0000	40.9440	67.9957	4065.0000	41.1107	67.5121	4115.0000	41.2775	67.0403
4016.0000	40.9474	67.9859	4066.0000	41.1141	67.5026	4116.0000	41.2808	67.0308
4017.0000	40.9507	67.9761	4067.0000	41.1174	67.4930	4117.0000	41.2841	67.0215
4018.0000	40.9540	67.9663	4068.0000	41.1207	67.4834	4118.0000	41.2875	67.0122
4019.0000	40.9574	67.9565	4069.0000	41.1241	67.4739	4119.0000	41.2908	67.0029
4020.0000	40.9607	67.9468	4070.0000	41.1274	67.4644	4120.0000	41.2941	66.9936
4021.0000	40.9640	67.9370	4071.0000	41.1307	67.4548	4121.0000	41.2975	66.9844
4022.0000	40.9674	67.9273	4072.0000	41.1341	67.4453	4122.0000	41.3008	66.9750
4023.0000	40.9707	67.9175	4073.0000	41.1374	67.4358	4123.0000	41.3041	66.9657
4024.0000	40.9740	67.9077	4074.0000	41.1408	67.4263	4124.0000	41.3075	66.9565
4025.0000	40.9774	67.8981	4075.0000	41.1441	67.4168	4125.0000	41.3108	66.9472
4026.0000	40.9807	67.8883	4076.0000	41.1474	67.4072	4126.0000	41.3141	66.9379
4027.0000	40.9840	67.8785	4077.0000	41.1508	67.3977	4127.0000	41.3175	66.9287
4028.0000	40.9874	67.8688	4078.0000	41.1541	67.3883	4128.0000	41.3208	66.9194
4029.0000	40.9907	67.8591	4079.0000	41.1574	67.3788	4129.0000	41.3241	66.9101
4030.0000	40.9940	67.8493	4080.0000	41.1608	67.3693	4130.0000	41.3275	66.9009
4031.0000	40.9974	67.8396	4081.0000	41.1641	67.3598	4131.0000	41.3308	66.8916
4032.0000	41.0007	67.8299	4082.0000	41.1674	67.3503	4132.0000	41.3341	66.8823
4033.0000	41.0040	67.8202	4083.0000	41.1708	67.3409	4133.0000	41.3375	66.8731
4034.0000	41.0074	67.8105	4084.0000	41.1741	67.3314	4134.0000	41.3408	66.8639
4035.0000	41.0107	67.8008	4085.0000	41.1774	67.3219	4135.0000	41.3441	66.8546
4036.0000	41.0140	67.7910	4086.0000	41.1808	67.3125	4136.0000	41.3475	66.8454
4037.0000	41.0174	67.7815	4087.0000	41.1841	67.3030	4137.0000	41.3508	66.8361
4038.0000	41.0207	67.7717	4088.0000	41.1874	67.2935	4138.0000	41.3541	66.8269
4039.0000	41.0241	67.7621	4089.0000	41.1908	67.2842	4139.0000	41.3575	66.8178
4040.0000	41.0274	67.7524	4090.0000	41.1941	67.2747	4140.0000	41.3608	66.8085
4041.0000	41.0307	67.7427	4091.0000	41.1974	67.2652	4141.0000	41.3642	66.7993
4042.0000	41.0341	67.7331	4092.0000	41.2008	67.2558	4142.0000	41.3675	66.7901
4043.0000	41.0374	67.7234	4093.0000	41.2041	67.2463	4143.0000	41.3708	66.7809
4044.0000	41.0407	67.7137	4094.0000	41.2074	67.2369	4144.0000	41.3742	66.7718
4045.0000	41.0441	67.7041	4095.0000	41.2108	67.2275	4145.0000	41.3775	66.7625
4046.0000	41.0474	67.6945	4096.0000	41.2141	67.2181	4146.0000	41.3808	66.7534
4047.0000	41.0507	67.6847	4097.0000	41.2174	67.2086	4147.0000	41.3842	66.7442
4048.0000	41.0541	67.6752	4098.0000	41.2208	67.1993	4148.0000	41.3875	66.7349
4049.0000	41.0574	67.6656	4099.0000	41.2241	67.1900	4149.0000	41.3908	66.7258

You can put text you want/need down here in the footer section.