HUTCHISON

# CALCULATOR No. 2

Formulae by **MUELLER CO.**

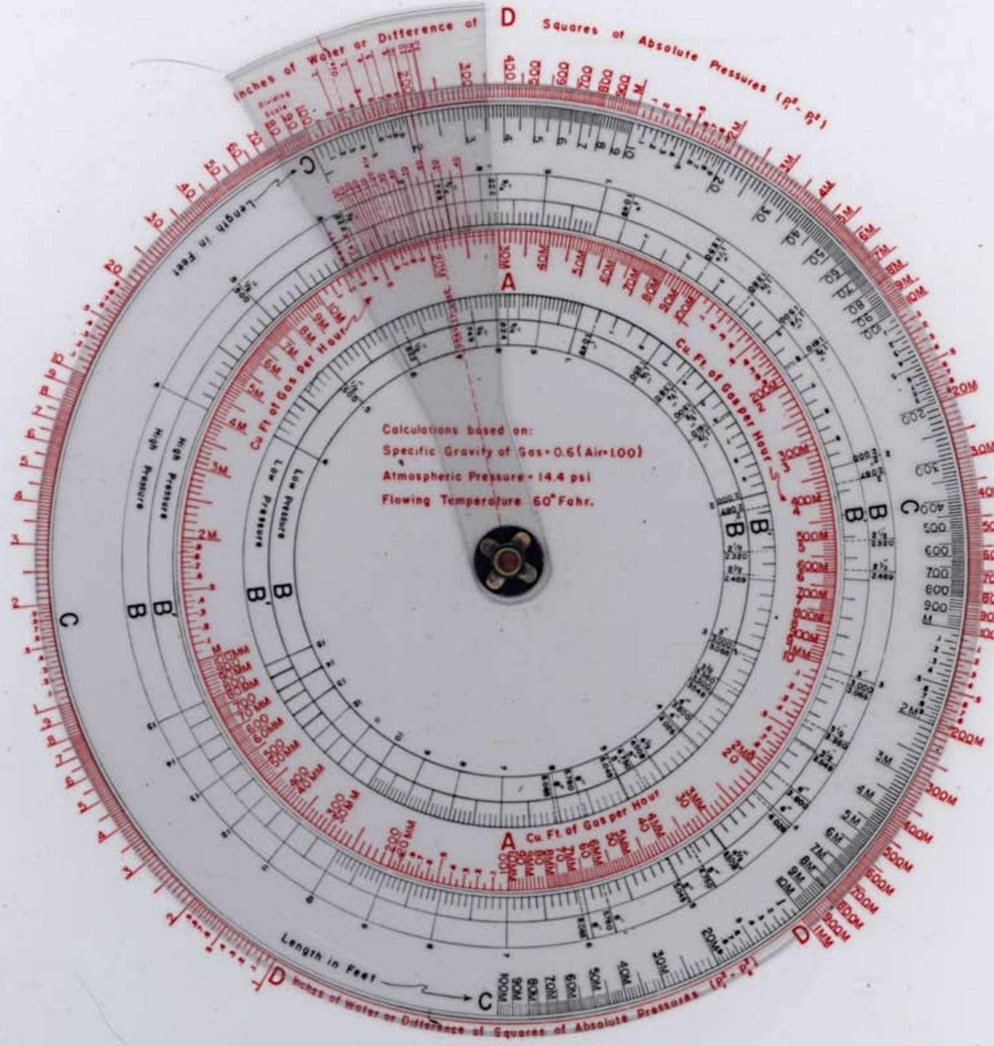
## for gas and air flows in smooth tubing and plastic pipe

**MUELLER CO.** *Decatur, Illinois*

# THE HUTCHISON CALCULATOR NO. 2

FOR GAS AND AIR FLOWS IN
SMOOTH PIPE SUCH AS
PLASTICS, COPPER, BRASS, ETC.

FORMULAE BY MUELLER CO.
DECATUR, ILLINOIS




**MUELLER CO. Since 1857**
GAS DISTRIBUTION PRODUCTS
AND EQUIPMENT



BY
ROBERT M. HUTCHISON
HOUSTON, TEXAS

Bob Curry

# How to use it:

**The Hutchison Calculator No.2** solves problems in the flow of gas or air in tubes and plastic pipe, using the Mueller Formulae.

For low pressure installations of smooth pipe such as plastics, copper, brass, etc. under 1 pound per square inch gage.

$$Q = \frac{2971}{G^{0.425}} \left(\frac{h}{L}\right)^{0.575} \times d^{2.725}$$

For high pressure installations of smooth pipe such as plastics, copper, brass, etc. over 1 pound per square inch gage.

$$Q = \frac{2826}{G^{0.425}} \left[\frac{P_1^2 - P_2^2}{L}\right]^{0.575} \times d^{2.725}$$

Q = rate of flow in cubic feet per hour of gas with standard conditions; that is, a pressure base of 14.7 pounds per square inch absolute and a temperature of 60° F.

G = specific gravity of the gas (air = 1)
h = pressure loss in inches of water column
d = actual internal diameter of pipe (in inches)
L = length of pipe run in feet
$P_1$ = inlet pressure in pounds per square inch absolute
$P_2$ = outlet pressure in pounds per square inch absolute

The formulae in simplified form are corrected to the following standard conditions:

14.4 pounds per square inch absolute atmospheric pressure
0.60 specific gravity
60° Fahr. flowing temperature

$$Q = 3792K \left(\frac{h}{L}\right)^{0.575} \quad \text{L.P.}$$

$$Q = 3608K \left[\frac{P_1^2 - P_2^2}{L}\right]^{0.575} \quad \text{H.P.}$$

$$K = d^{2.725}$$

There are four scales on the calculator, viz. A, B, B', C and D.

Scale A is the volume scale — cubic feet of gas per hour.

Scale B and B' are the pipe size scales. The nominal size and I.D. are shown for sizes varying from ½" to 6" nominal diameter on Scale B. If the I.D. being used is not shown on Scale B, it can be located on Scale B'.

The low pressure constants are located on the two inside circles marked B and B'.

The high pressure constants are shown on the circles located outside of Scale A in the circles marked B and B' — High Pressure. The inside pipe diameters shown in the circles marked B are those given in Specifications T.P. 2-52 and T.P. 3-52 for plastic pipe.

Scale C is the length scale; read in feet.

Scale D is the pressure drop scale and is read as inches of water column "h" or the difference of the squares of the absolute pressures ($P_1^2 - P_2^2$).

The pressure table which accompanies the instrument gives the gage pressure and the square of the corresponding absolute pressure. The columns marked "P" give gage pressure and the columns marked $(P+14.4)^2$ give the square of the absolute. The pressure table is used in solving problems of flow where the line pressure exceeds 1 pound per square inch gage.

## Operating the Instrument:

In general, the following four rules will solve most of the problems of flow.

1. To solve for pressure drop: (use the edge of the Indicator for aligning) Set the mark indicating the size of pipe on Scale B or B' directly opposite the line indicating the volume on Scale A. Find length of line on Scale C and opposite on Scale D read the pressure drop in either inches of water for pressures below one pound gage or ($P_1^2 - P_2^2$) the difference of the squares of the inlet and outlet absolute pressures.
2. To solve for volume: Set the length of line on Scale C opposite the pressure drop on Scale D. Find the size of pipe on Scale B and opposite on Scale A read quantity of flow.
3. To solve for length of line: Set the size of line on Scale B opposite flow on Scale A. Find pressure drop on Scale D and opposite on Scale C find length.
4. To solve for pipe size: Set length of line on Scale C opposite pressure drop on Scale D. Find volume on Scale A and read on Scale B the pipe size nearest to this volume.

## Use of Gravity Scale:

The calculations for gas solved on this instrument are based on 0.6 specific gravity, air being taken as 1.0; and it is therefore necessary to make corrections for specific gravity if the problem deals with a gas other than that of 0.6 sp. gr.

The gravity scale is located on the indicator and the volumes can be corrected as follows:

To correct 10M (10,000) cu. ft. of gas at .90 gr. to 0.6 gravity: Set the line marked ".90" on the gravity scale over the "10,000" mark "10M" on Scale A and under the line marked ".60" on the gravity scale; read on Scale A 11,900 cu. ft., which is the corrected value. To convert from .60 gravity to some other gravity, the operation is the reverse of the above.

**ILLUSTRATIONS:**

Solution of a few typical problems: (M=1,000; MM=Million)

**High Pressure Gas:**

Given 10,000 cu.ft. per hour at.8 sp.gr. Length 2,000 ft. Size 4". Initial pressure 10# per sq.in. gage. Find final pressure and drop.

1. Set .80 on gravity scale over the 10M mark on Scale A.
2. Revolve sliding circle until the line marked 4"(use outside circles) for the specification desired, which in this case we will assume is 4.026 (T.P. 2-52) which is under the point .60 line on the gravity scale.
3. Now on Scale C find 2,000 ft. and opposite on Scale D read 20. This is the difference of the squares of the absolute pressures.
4. Now consult the pressure table, and opposite 10#, the initial pressure, find in the next column the value 595, subtract 20 (the amount found above) from this value, leaving 575. Find 575 or value closest to it in the column of squares on the pressure table, and in the column on the left read 9.6, which is the final pressure.
5. The pressure drop is 10# minus 9.6 = 0.4.

In the above problem if 10# were the final pressure and the initial pressure were sought, the value would be added to 595, giving 605 and the initial pressure would be found to be 10.2#.

**Low Pressure Gas:**

Given 10,000 cu. ft. of gas at .80 sp. gr. Size of line 4". Length 2,000 ft. Find pressure drop in inches of water.

1. Set .80 on gravity scale over 10M cu. ft. on Scale A.
2. Revolve sliding circle until the line for 4" pipe (use inside circles for L.P.), selecting the desired I.D. pipe specification which we will assume to be T.P. 2-52 or 4.026, is under the .60 line on the gravity scale.
3. Find length 2000 (2M) on Scale C and opposite on Scale D find 18.5", the pressure drop in inches of water.

If the result is desired in ounces, move the indicator until the line marked OZS is over the 18.5 line and at the left edge of the indicator read on Scale A 10.7 ounces.

To change from ounces to inches, reverse this operation.

Now suppose there were 50 customers being supplied, at regular intervals, from this line, and that all of the 10,000 cu.ft. of gas were being used by these customers, each using the same amount, then the pressure drop would be less than that calculated in the above problem; and in order to find what the drop would be under this condition, set the line marked 50 on the Dividing Scale over the 18.5 line, and at the left hand edge of the indicator, read 6.3" of water as the total actual drop in the line.

The same rule applies on high pressure problems, only the correction is made on the quantity found to be the difference of squares of the absolute pressures.

**Daily or Hourly Results:**

As mentioned above, the quantities of gas are expressed as so many cu. ft. per hour.

If it is desired to know the daily results, simply set the left edge of the indicator on the hourly flow, using Scale A; read the right hand edge of the indicator and multiply by 10 for the daily flow. (Example: With the left hand edge on 10,000, the right hand edge is over 24,000 — multiply by 10 — equals 240,000–the daily flow.)

To change from daily to hourly flow, set the right hand edge on the daily; read the left hand edge and divide by 10.

As stated above all gas volumes are calculated at a pressure base of 14.4 p.s.i. abs. or 0 pounds p.s.i. gage.

To change to a new pressure base, use the following multipliers:

| New Pressure | Base Multiplier |
|---|---|
| 0 | 1.000 |
| 4 oz. | .9829 |
| 8 oz. | .9664 |
| 1 lb. | .9351 |
| 2 lb. | .8780 |

There are many special problems, such as looped lines, parallel lines, equivalent lengths and different I.D. pipes in series that can be worked on this instrument; and after the operator has used it for a while, the solution of the special problems will become simple.



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# PRESSURE TA

Vacuum Table

| Ins. Na. | (lbs □" Abs)$^2$ |
|---|---|
| .5 | 199 |
| 1.0 | 193 |
| .5 | 185 |
| 2.0 | 179 |
| .5 | 174 |
| 3.0 | 166 |
| .5 | 161 |
| 4.0 | 154 |
| .5 | 149 |
| 5.0 | 142 |
| .5 | 137 |
| 6.0 | 130 |
| .5 | 125 |
| 7.0 | 119 |
| .5 | 114 |
| 8.0 | 108 |
| .5 | 104 |
| 9.0 | 98 |
| .5 | 94 |
| 10.0 | 90 |
| .5 | 85 |
| 11.0 | 81 |
| .5 | 76 |
| 12.0 | 72 |
| .5 | 67 |
| 13.0 | 64 |
| .5 | 60 |
| 14.0 | 56 |
| .5 | 53 |
| 15.0 | 49 |
| .5 | 46 |
| 16.0 | 42 |
| .5 | 39 |
| 17.0 | 36 |
| .5 | 34 |
| 18.0 | 30 |
| .5 | 28 |
| 19.0 | 25 |
| .5 | 23 |
| 20.0 | 21 |
| .5 | 18 |
| 21.0 | 16 |
| .5 | 14 |
| 22.0 | 13 |
| .5 | 11 |
| 23.0 | 9 |
| .5 | 8 |
| 24.0 | 7 |
| .5 | 5 |
| 25.0 | 4 |
| .5 | 3 |
| 26.0 | 2 |
| .5 | 2 |
| 27.0 | 1 |
| .5 | .81 |
| 28.0 | .49 |
| .5 | .16 |
| 29.0 | .04 |

| P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| .0 | 207 | 6.0 | 416 | 12.0 | 697 | 18.0 | 1050 | 24.0 | 1475 | 30.0 | 1971 | 36.0 | 2540 | 42.0 | 3181 | 48.0 | 3894 | 54.0 |
| .1 | 210 | .1 | 420 | .1 | 702 | .1 | 1056 | .1 | 1482 | .1 | 1980 | .1 | 2550 | .1 | 3192 | .1 | 3906 | .1 |
| .2 | 213 | .2 | 424 | .2 | 707 | .2 | 1063 | .2 | 1490 | .2 | 1989 | .2 | 2560 | .2 | 3203 | .2 | 3919 | .2 |
| .3 | 216 | .3 | 428 | .3 | 713 | .3 | 1069 | .3 | 1498 | .3 | 1998 | .3 | 2570 | .3 | 3215 | .3 | 3931 | .3 |
| .4 | 219 | .4 | 433 | .4 | 718 | .4 | 1076 | .4 | 1505 | .4 | 2007 | .4 | 2581 | .4 | 3226 | .4 | 3944 | .4 |
| .5 | 222 | .5 | 437 | .5 | 724 | .5 | 1082 | .5 | 1513 | .5 | 2016 | .5 | 2591 | .5 | 3238 | .5 | 3956 | .5 |
| .6 | 225 | .6 | 441 | .6 | 729 | .6 | 1089 | .6 | 1521 | .6 | 2025 | .6 | 2601 | .6 | 3249 | .6 | 3969 | .6 |
| .7 | 228 | .7 | 445 | .7 | 734 | .7 | 1096 | .7 | 1529 | .7 | 2034 | .7 | 2611 | .7 | 3260 | .7 | 3982 | .7 |
| .8 | 231 | .8 | 449 | .8 | 740 | .8 | 1102 | .8 | 1537 | .8 | 2043 | .8 | 2621 | .8 | 3272 | .8 | 3994 | .8 |
| .9 | 234 | .9 | 454 | 9 | 745 | .9 | 1109 | .9 | 1544 | .9 | 2052 | .9 | 2632 | .9 | 3283 | .9 | 4007 | .9 |
| 1.0 | 237 | 7.0 | 458 | 13.0 | 751 | 19.0 | 1115 | 25.0 | 1552 | 31.0 | 2061 | 37.0 | 2642 | 43.0 | 3295 | 49.0 | 4019 | 55.0 |
| .1 | 240 | .1 | 462 | .1 | 756 | .1 | 1122 | .1 | 1560 | .1 | 2070 | .1 | 2652 | .1 | 3306 | .1 | 4032 | .1 |
| .2 | 243 | .2 | 466 | .2 | 762 | .2 | 1129 | .2 | 1568 | .2 | 2079 | .2 | 2662 | .2 | 3318 | .2 | 4045 | .2 |
| .3 | 246 | .3 | 471 | .3 | 767 | .3 | 1136 | .3 | 1576 | .3 | 2088 | .3 | 2673 | .3 | 3329 | .3 | 4058 | .3 |
| .4 | 249 | .4 | 475 | .4 | 773 | .4 | 1142 | .4 | 1584 | .4 | 2098 | .4 | 2683 | .4 | 3341 | .4 | 4070 | .4 |
| .5 | 253 | .5 | 480 | .5 | 778 | .5 | 1149 | .5 | 1592 | .5 | 2107 | .5 | 2694 | .5 | 3352 | .5 | 4083 | .5 |
| .6 | 256 | .6 | 484 | .6 | 784 | .6 | 1156 | .6 | 1600 | .6 | 2116 | .6 | 2704 | .6 | 3364 | .6 | 4096 | .6 |
| .7 | 259 | .7 | 488 | .7 | 790 | .7 | 1163 | .7 | 1608 | .7 | 2125 | .7 | 2714 | .7 | 3376 | .7 | 4109 | .7 |
| .8 | 262 | .8 | 493 | .8 | 795 | .8 | 1170 | .8 | 1616 | .8 | 2134 | .8 | 2725 | .8 | 3387 | .8 | 4122 | .8 |
| .9 | 266 | .9 | 497 | .9 | 801 | .9 | 1176 | .9 | 1624 | .9 | 2144 | .9 | 2735 | .9 | 3399 | .9 | 4134 | .9 |
| 2.0 | 269 | 8.0 | 502 | 14.0 | 806 | 20.0 | 1183 | 26.0 | 1632 | 32.0 | 2153 | 38.0 | 2746 | 44.0 | 3410 | 50.0 | 4147 | 56.0 |
| .1 | 272 | .1 | 506 | .1 | 812 | .1 | 1190 | .1 | 1640 | .1 | 2162 | .1 | 2756 | .1 | 3422 | .1 | 4160 | .1 |
| .2 | 275 | .2 | 511 | .2 | 818 | .2 | 1197 | .2 | 1648 | .2 | 2172 | .2 | 2767 | .2 | 3434 | .2 | 4173 | .2 |
| .3 | 279 | .3 | 515 | .3 | 824 | .3 | 1204 | .3 | 1656 | .3 | 2181 | .3 | 2777 | .3 | 3446 | .3 | 4186 | .3 |
| .4 | 282 | .4 | 520 | .4 | 829 | .4 | 1211 | .4 | 1665 | .4 | 2190 | .4 | 2788 | .4 | 3457 | .4 | 4199 | .4 |
| .5 | 286 | .5 | 524 | .5 | 835 | .5 | 1218 | .5 | 1673 | .5 | 2200 | .5 | 2798 | .5 | 3469 | .5 | 4212 | .5 |
| .6 | 289 | .6 | 529 | .6 | 841 | .6 | 1225 | .6 | 1681 | .6 | 2209 | .6 | 2809 | .6 | 3481 | .6 | 4225 | .6 |
| .7 | 292 | .7 | 534 | .7 | 847 | .7 | 1232 | .7 | 1689 | .7 | 2218 | .7 | 2820 | .7 | 3493 | .7 | 4238 | .7 |
| .8 | 296 | .8 | 538 | .8 | 853 | .8 | 1239 | .8 | 1697 | .8 | 2228 | .8 | 2830 | .8 | 3505 | .8 | 4251 | .8 |
| .9 | 299 | .9 | 543 | .9 | 858 | .9 | 1246 | .9 | 1706 | .9 | 2237 | .9 | 2841 | .9 | 3516 | .9 | 4264 | .9 |
| 3.0 | 303 | 9.0 | 547 | 15.0 | 864 | 21.0 | 1253 | 27.0 | 1714 | 33.0 | 2247 | 39.0 | 2851 | 45.0 | 3528 | 51.0 | 4277 | 57.0 |
| .1 | 306 | .1 | 552 | .1 | 870 | .1 | 1260 | .1 | 1722 | .1 | 2256 | .1 | 2862 | .1 | 3540 | .1 | 4290 | .1 |
| .2 | 310 | .2 | 557 | .2 | 876 | .2 | 1267 | .2 | 1730 | .2 | 2266 | .2 | 2873 | .2 | 3552 | .2 | 4303 | .2 |
| .3 | 313 | .3 | 562 | .3 | 882 | .3 | 1274 | .3 | 1739 | 3 | 2275 | .3 | 2884 | .3 | 3564 | .3 | 4316 | .3 |
| .4 | 317 | .4 | 566 | .4 | 888 | .4 | 1281 | .4 | 1747 | .4 | 2285 | .4 | 2894 | .4 | 3576 | .4 | 4329 | .4 |
| .5 | 320 | .5 | 571 | .5 | 894 | .5 | 1288 | .5 | 1756 | .5 | 2294 | .5 | 2905 | .5 | 3588 | .5 | 4343 | .5 |
| .6 | 324 | .6 | 576 | .6 | 900 | .6 | 1296 | .6 | 1764 | .6 | 2304 | .6 | 2916 | .6 | 3600 | .6 | 4356 | .6 |
| .7 | 328 | .7 | 581 | .7 | 906 | .7 | 1303 | .7 | 1772 | .7 | 2314 | .7 | 2927 | .7 | 3612 | .7 | 4369 | .7 |
| .8 | 331 | .8 | 586 | .8 | 912 | .8 | 1310 | .8 | 1781 | .8 | 2323 | .8 | 2938 | .8 | 3624 | .8 | 4382 | .8 |
| .9 | 335 | .9 | 590 | .9 | 918 | .9 | 1318 | .9 | 1789 | 9 | 2333 | .9 | 2948 | .9 | 3636 | .9 | 4396 | .9 |
| 4.0 | 338 | 10.0 | 595 | 16.0 | 924 | 22.0 | 1325 | 28.0 | 1798 | 34.0 | 2343 | 40.0 | 2959 | 46.0 | 3648 | 52.0 | 4409 | 58.0 |
| .1 | 342 | .1 | 600 | .1 | 930 | .1 | 1332 | .1 | 1806 | .1 | 2352 | .1 | 2970 | .1 | 3660 | .1 | 4422 | .1 |
| .2 | 346 | .2 | 605 | .2 | 936 | .2 | 1339 | .2 | 1815 | .2 | 2362 | .2 | 2981 | .2 | 3672 | .2 | 4435 | .2 |
| .3 | 350 | .3 | 610 | .3 | 942 | .3 | 1347 | .3 | 1823 | .3 | 2372 | .3 | 2992 | .3 | 3684 | .3 | 4449 | .3 |
| .4 | 353 | .4 | 615 | .4 | 949 | .4 | 1354 | .4 | 1832 | .4 | 2381 | .4 | 3003 | .4 | 3697 | .4 | 4462 | .4 |
| .5 | 357 | .5 | 620 | .5 | 955 | .5 | 1362 | .5 | 1840 | .5 | 2391 | .5 | 3014 | .5 | 3709 | .5 | 4476 | .5 |
| .6 | 361 | .6 | 625 | .6 | 961 | .6 | 1369 | .6 | 1849 | .6 | 2401 | .6 | 3025 | .6 | 3721 | .6 | 4489 | .6 |
| .7 | 365 | .7 | 630 | .7 | 967 | .7 | 1376 | .7 | 1858 | .7 | 2411 | .7 | 3036 | .7 | 3733 | .7 | 4502 | .7 |
| .8 | 369 | .8 | 635 | .8 | 973 | .8 | 1384 | .8 | 1866 | .8 | 2421 | .8 | 3047 | .8 | 3745 | .8 | 4516 | .8 |
| .9 | 372 | .9 | 640 | .9 | 980 | .9 | 1391 | .9 | 1875 | .9 | 2430 | .9 | 3058 | .9 | 3758 | .9 | 4529 | .9 |
| 5.0 | 376 | 11.0 | 645 | 17.0 | 986 | 23.0 | 1399 | 29.0 | 1883 | 35.0 | 2440 | 41.0 | 3069 | 47.0 | 3770 | 53.0 | 4543 | 59.0 |
| .1 | 380 | .1 | 650 | .1 | 992 | .1 | 1406 | .1 | 1892 | .1 | 2450 | .1 | 3080 | .1 | 3782 | .1 | 4556 | .1 |
| .2 | 384 | .2 | 655 | .2 | 998 | .2 | 1414 | .2 | 1901 | .2 | 2460 | .2 | 3091 | .2 | 3794 | .2 | 4570 | .2 |
| .3 | 388 | .3 | 660 | .3 | 1005 | .3 | 1421 | .3 | 1910 | .3 | 2470 | .3 | 3102 | .3 | 3807 | .3 | 4583 | .3 |
| .4 | 392 | .4 | 665 | .4 | 1011 | .4 | 1429 | .4 | 1918 | .4 | 2480 | .4 | 3114 | .4 | 3819 | .4 | 4597 | .4 |
| .5 | 396 | .5 | 670 | .5 | 1018 | .5 | 1436 | .5 | 1927 | .5 | 2490 | .5 | 3125 | .5 | 3832 | .5 | 4610 | .5 |
| .6 | 400 | .6 | 676 | .6 | 1024 | .6 | 1444 | .6 | 1937 | .6 | 2500 | .6 | 3136 | .6 | 3844 | .6 | 4624 | .6 |
| .7 | 404 | .7 | 681 | .7 | 1030 | .7 | 1452 | .7 | 1945 | .7 | 2510 | .7 | 3147 | .7 | 3856 | .7 | 4638 | .7 |
| .8 | 408 | .8 | 686 | .8 | 1037 | .8 | 1459 | .8 | 1954 | .8 | 2520 | .8 | 3158 | .8 | 3869 | .8 | 4651 | .8 |
| | | | | | | | | | | | | | | | 3881 | .9 | 4665 | .9 |

E

| P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ | P | $(P+14.4)^2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 60.0 | 5535 | 66.0 | 6464 | 72.0 | 7465 | 78.0 | 8538 | 84.0 | 9682 | 90.0 | 10900 | 96.0 | 12188 | 200 | 45967 | 600 | 377487 |
| .1 | 5550 | .1 | 6480 | .1 | 7482 | .1 | 8556 | .1 | 9702 | .1 | 10920 | .1 | 12210 | 205 | 48136 | 610 | 389875 |
| .2 | 5565 | .2 | 6496 | .2 | 7499 | .2 | 8575 | .2 | 9722 | .2 | 10941 | .2 | 12232 | 210 | 50355 | 620 | 402463 |
| .3 | 5580 | .3 | 6512 | .3 | 7517 | .3 | 8593 | .3 | 9742 | .3 | 10962 | .3 | 12254 | 215 | 52624 | 630 | 415251 |
| .4 | 5595 | .4 | 6529 | .4 | 7534 | .4 | 8611 | .4 | 9761 | .4 | 10983 | .4 | 12276 | 220 | 54943 | 640 | 428239 |
| .5 | 5610 | .5 | 6545 | .5 | 7552 | .5 | 8630 | .5 | 9781 | .5 | 11004 | .5 | 12298 | 225 | 57312 | 650 | 441427 |
| .6 | 5625 | .6 | 6561 | .6 | 7569 | .6 | 8649 | .6 | 9801 | .6 | 11025 | .6 | 12321 | 230 | 59731 | 660 | 454815 |
| .7 | 5640 | .7 | 6577 | .7 | 7586 | .7 | 8668 | .7 | 9821 | .7 | 11046 | .7 | 12343 | 235 | 62200 | 670 | 468403 |
| .8 | 5655 | .8 | 6593 | .8 | 7604 | .8 | 8686 | .8 | 9841 | .8 | 11067 | .8 | 12365 | 240 | 64719 | 680 | 482191 |
| .9 | 5670 | .9 | 6610 | .9 | 7621 | .9 | 8705 | .9 | 9860 | .9 | 11088 | .9 | 12388 | 245 | 67288 | 690 | 496179 |
| 61.0 | 5685 | 67.0 | 6626 | 73.0 | 7639 | 79.0 | 8723 | 85.0 | 9880 | 91.0 | 11109 | 97.0 | 12410 | 250 | 69907 | 700 | 510367 |
| .1 | 5700 | .1 | 6642 | .1 | 7656 | .1 | 8742 | .1 | 9900 | .1 | 11130 | .1 | 12432 | 255 | 72576 | 710 | 524755 |
| .2 | 5715 | .2 | 6658 | .2 | 7674 | .2 | 8761 | .2 | 9920 | .2 | 11151 | .2 | 12454 | 260 | 75295 | 720 | 539343 |
| .3 | 5730 | .3 | 6675 | .3 | 7691 | .3 | 8780 | .3 | 9940 | .3 | 11172 | .3 | 12476 | 265 | 78064 | 730 | 554131 |
| .4 | 5746 | .4 | 6691 | .4 | 7709 | .4 | 8798 | .4 | 9960 | .4 | 11193 | .4 | 12499 | 270 | 80883 | 740 | 569119 |
| .5 | 5761 | .5 | 6708 | .5 | 7726 | .5 | 8817 | .5 | 9980 | .5 | 11214 | .5 | 12522 | 275 | 83752 | 750 | 584307 |
| .6 | 5776 | .6 | 6724 | .6 | 7744 | .6 | 8836 | .6 | 10000 | .6 | 11236 | .6 | 12545 | 280 | 86671 | 760 | 599695 |
| .7 | 5791 | .7 | 6740 | .7 | 7762 | .7 | 8855 | .7 | 10020 | .7 | 11257 | .7 | 12567 | 285 | 89640 | 770 | 615283 |
| .8 | 5806 | .8 | 6757 | .8 | 7779 | .8 | 8874 | .8 | 10040 | .8 | 11278 | .8 | 12589 | 290 | 92659 | 780 | 631071 |
| .9 | 5822 | .9 | 6773 | .9 | 7797 | .9 | 8892 | .9 | 10060 | .9 | 11300 | .9 | 12611 | 295 | 95728 | 790 | 647059 |
| 62.0 | 5837 | 68.0 | 6790 | 74.0 | 7814 | 80.0 | 8911 | 86.0 | 10080 | 92.0 | 11321 | 98.0 | 12633 | 300 | 98847 | 800 | 663247 |
| .1 | 5852 | .1 | 6806 | .1 | 7832 | .1 | 8930 | .1 | 10100 | .1 | 11342 | .1 | 12655 | 305 | 102016 | 810 | 679635 |
| .2 | 5867 | .2 | 6823 | .2 | 7850 | .2 | 8949 | .2 | 10120 | .2 | 11363 | .2 | 12672 | 310 | 105235 | 820 | 696223 |
| .3 | 5883 | .3 | 6839 | .3 | 7868 | .3 | 8968 | .3 | 10140 | .3 | 11385 | .3 | 12700 | 315 | 108504 | 830 | 713011 |
| .4 | 5898 | .4 | 6856 | .4 | 7885 | .4 | 8987 | .4 | 10160 | .4 | 11406 | .4 | 12723 | 320 | 111823 | 840 | 729999 |
| .5 | 5914 | .5 | 6872 | .5 | 7903 | .5 | 9006 | .5 | 10180 | .5 | 11429 | .5 | 12746 | 325 | 115192 | 850 | 747187 |
| .6 | 5929 | .6 | 6889 | .6 | 7921 | .6 | 9025 | .6 | 10201 | .6 | 11449 | .6 | 12769 | 330 | 118611 | 860 | 764575 |
| .7 | 5944 | .7 | 6906 | .7 | 7939 | .7 | 9044 | .7 | 10221 | .7 | 11470 | .7 | 12791 | 335 | 122080 | 870 | 782163 |
| .8 | 5960 | .8 | 6922 | .8 | 7957 | .8 | 9063 | .8 | 10241 | .8 | 11492 | .8 | 12813 | 340 | 125599 | 880 | 799951 |
| .9 | 5975 | .9 | 6939 | .9 | 7974 | .9 | 9082 | .9 | 10261 | .9 | 11513 | .9 | 12835 | 345 | 129168 | 890 | 817939 |
| 63.0 | 5991 | 69.0 | 6955 | 75.0 | 7992 | 81.0 | 9101 | 87.0 | 10282 | 93.0 | 11535 | 99.0 | 12858 | 350 | 132787 | 900 | 836127 |
| .1 | 6006 | .1 | 6972 | .1 | 8010 | .1 | 9120 | .1 | 10302 | .1 | 11556 | .1 | 12881 | 355 | 136456 | 910 | 854515 |
| .2 | 6022 | .2 | 6989 | .2 | 8028 | .2 | 9139 | .2 | 10322 | .2 | 11577 | .2 | 12904 | 360 | 140175 | 920 | 873103 |
| .3 | 6037 | .3 | 7006 | .3 | 8046 | .3 | 9158 | .3 | 10342 | .3 | 11599 | .3 | 12927 | 365 | 143944 | 930 | 891891 |
| .4 | 6053 | .4 | 7022 | .4 | 8064 | .4 | 9178 | .4 | 10363 | .4 | 11621 | .4 | 12950 | 370 | 147763 | 940 | 910879 |
| .5 | 6068 | .5 | 7039 | .5 | 8082 | .5 | 9197 | .5 | 10384 | .5 | 11642 | .5 | 12973 | 375 | 151632 | 950 | 930067 |
| .6 | 6084 | .6 | 7056 | .6 | 8100 | .6 | 9216 | .6 | 10404 | .6 | 11663 | .6 | 12996 | 380 | 155551 | 960 | 949455 |
| .7 | 6100 | .7 | 7073 | .7 | 8118 | .7 | 9235 | .7 | 10424 | .7 | 11684 | .7 | 13019 | 385 | 159520 | 970 | 969043 |
| .8 | 6115 | .8 | 7090 | .8 | 8136 | .8 | 9254 | .8 | 10445 | .8 | 11706 | .8 | 13042 | 390 | 163539 | 980 | 988831 |
| .9 | 6131 | .9 | 7106 | .9 | 8154 | .9 | 9274 | .9 | 10465 | .9 | 11727 | .9 | 13065 | 395 | 167608 | 990 | 1008819 |
| 64.0 | 6147 | 70.0 | 7123 | 76.0 | 8172 | 82.0 | 9292 | 88.0 | 10486 | 94.0 | 11749 | 100.0 | 13087 | 400 | 171727 | 1000 | 1029007 |
| .1 | 6162 | .1 | 7140 | .1 | 8190 | .1 | 9312 | .1 | 10506 | .1 | 11771 | 105 | 14256 | 410 | 180115 | | |
| .2 | 6178 | .2 | 7157 | .2 | 8208 | .2 | 9331 | .2 | 10527 | .2 | 11793 | 110 | 15475 | 420 | 188703 | | |
| .3 | 6194 | .3 | 7174 | .3 | 8226 | .3 | 9351 | .3 | 10547 | .3 | 11815 | 115 | 16744 | 430 | 197491 | | |
| .4 | 6209 | .4 | 7191 | .4 | 8245 | .4 | 9370 | .4 | 10568 | .4 | 11837 | 120 | 18063 | 440 | 206479 | | |
| .5 | 6225 | .5 | 7208 | .5 | 8263 | .5 | 9390 | .5 | 10588 | .5 | 11854 | 125 | 19432 | 450 | 215667 | | |
| .6 | 6241 | .6 | 7225 | .6 | 8281 | .6 | 9409 | .6 | 10609 | .6 | 11881 | 130 | 20851 | 460 | 225055 | | |
| .7 | 6257 | .7 | 7242 | .7 | 8299 | .7 | 9428 | .7 | 10629 | .7 | 11902 | 135 | 22320 | 470 | 234643 | | |
| .8 | 6273 | .8 | 7259 | .8 | 8317 | .8 | 9448 | .8 | 10650 | .8 | 11924 | 140 | 23839 | 480 | 244431 | | |
| .9 | 6288 | .9 | 7276 | .9 | 8336 | .9 | 9467 | .9 | 10670 | .9 | 11946 | 145 | 25408 | 490 | 254419 | | |
| 65.0 | 6304 | 71.0 | 7293 | 77.0 | 8354 | 83.0 | 9487 | 89.0 | 10691 | 95.0 | 11968 | 150 | 27027 | 500 | 264607 | | |
| .1 | 6320 | .1 | 7310 | .1 | 8372 | .1 | 9506 | .1 | 10712 | .1 | 11990 | 155 | 28696 | 510 | 274995 | | |
| .2 | 6336 | .2 | 7327 | .2 | 8390 | .2 | 9526 | .2 | 10732 | .2 | 12012 | 160 | 30415 | 520 | 285583 | | |
| .3 | 6352 | .3 | 7344 | .3 | 8409 | .3 | 9545 | .3 | 10753 | .3 | 12034 | 165 | 32184 | 530 | 296371 | | |
| .4 | 6368 | .4 | 7361 | .4 | 8427 | .4 | 9565 | .4 | 10774 | .4 | 12056 | 170 | 34003 | 540 | 307359 | | |
| .5 | 6384 | .5 | 7379 | .5 | 8446 | .5 | 9584 | .5 | 10795 | .5 | 12078 | 175 | 35872 | 550 | 318547 | | |
| .6 | 6400 | .6 | 7396 | .6 | 8464 | .6 | 9604 | .6 | 10816 | .6 | 12100 | 180 | 37791 | 560 | 329935 | | |
| .7 | 6416 | .7 | 7413 | .7 | 8482 | .7 | 9624 | .7 | 10837 | .7 | 12122 | 185 | 39760 | 570 | 341523 | | |
| .8 | 6432 | .8 | 7430 | .8 | 8501 | .8 | 9643 | .8 | 10858 | .8 | 12144 | 190 | 41779 | 580 | 353311 | | |
| .9 | 6448 | .9 | 7448 | .9 | 8519 | .9 | 9663 | .9 | 10879 | .9 | 12166 | 195 | 43848 | 590 | 365299 | | |