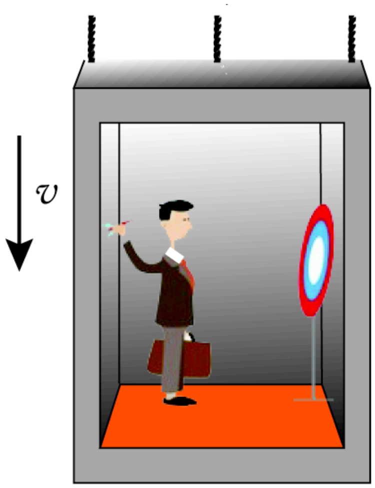
# 11thG Physics (2017– 18)
# 2nd Q Exam- Honors

(February 2, 2018)

| Class | No. | Name |
|---|---|---|




**In calculation problems, describe equations clearly and systematically enough to show how to solve the problems. If not enough, you won't get any point.**

5 points/problem x 21 problems= 105 points(Max 100 points)

| | |
|---|---|
| Exam | ／[Total 100 points] |
| Lab Reports | |

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| | |
|---|---|
| The circular constant | $\pi$ = 3.14159… |
| Mile | 1 mile = 1609 m |
| Gravitational acceleration rate | g = 9.80 m/s$^2$ |

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| | Density [kg/m$^3$] |
|---|---|
| Gold | 19,300 |
| Silver | 13,600 |
| Iron | 7,860 |
| Sea water | 1,025 |
| Water | 1,000 |
| Ice | 917 |
| Air | 1.29 |
| Helium | 0.179 |
| Hydrogen gas | 0.0899 |

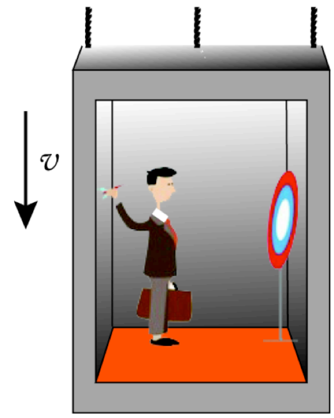
| Specific Heat c [J/(kg・K)] | |
|---|---|
| Water | 4186 |
| Ice | 2090 |
| Steam | 2010 |
| Oil | 1970 |
| Copper | 387 |
| Ceramic | 1090 |
| Glass | 837 |
| Aluminum | 900 |
| Iron (Steel) | 560 |
| Lead | 128 |

| | Latent Heat of Fusion $L_f$ [J/kg] | Latent Heat of Vaporization $L_v$ [J/kg] |
|---|---|---|
| Water | 3.35 x 10$^5$ | 22.6 x10$^5$ |



*2/2/2018 By Tohei Moritani..*

*Keio Academy of New York*




(1,2) Riding in an elevator moving downward with constant speed, you begin a game of darts.

(1) Do you have to aim your darts higher than, lower than, or the same as when you play darts on solid ground?

(2) Choose the best explanation from the following:

I. The elevator goes down during the time it takes for the dart to travel to the dashboard.

II. The elevator moves with constant velocity. Therefore Newton's laws apply within the elevator in the same way as on the ground.

III. You have to aim higher to compensate for the downward speed of the elevator.

| (1) Answer |
|---|
| |

| (2) Answer |
|---|
| |

(3) A 51.5-kg swimmer with an initial speed of 1.25 m/s decides to coast until she comes to rest. If she slows with constant acceleration and stops after coasting 2.20 m, what was the force exerted on her by the water?

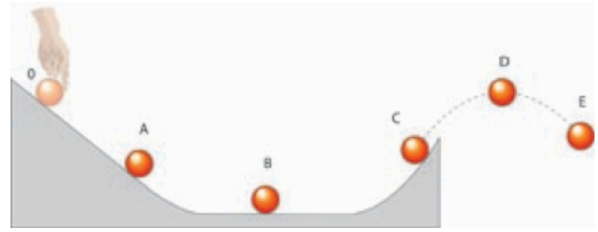
(Equations )

| (3) Answer |
|---|
| |



*2/2/2018 By Tohei Moritani..*

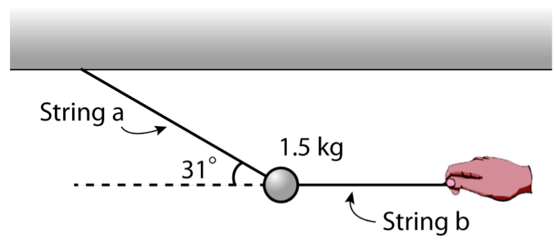
(4) A ball travels on a frictionless track and flies out of its edge to air, as shown in the figure. Draw arrows to show all the forces exerted on the ball that is passing at the points, A to E, ignoring friction and the resistance by air.




(4) Answer
Draw arrows in the figure.

(5) A 1.5 kg object is supported with two strings, a and b. The string b is kept horizontally. Find the magnitudes of the tensional forces for the strings, a and b.

(Equations)

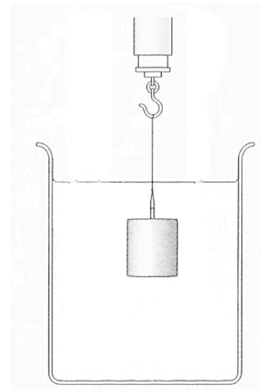



(5) Answer

String-a

String-b

(6) A solid block is suspended from a spring scale. When the block is in air, the scale reads 35.0 N and when immersed in water the scale reads 31.1 N.
What is the density of the block?
(Equations)



(6) Answer

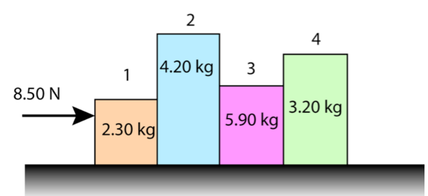


(13-a) Answer

(7) Find the minimum force necessary to break the balloon with a needle with the tip area of $2.8 \times 10^{-7}$ m$^2$, given that the balloon breaks with a pressure of $3.5 \times 10^5$ N/m$^2$.
(Equations)

(7) Answer

(8) A force of magnitude 8.50 N pushes four boxes with masses as shown. Find the magnitude of the contact force between boxes 3 and 4.
(Equations)




(8) Answer

(9) To move a large 35 kg crate across a rough floor, you push on it with a force at an angle of 22° below the horizontal, as shown the figure. Find the magnitude of the force necessary to start the crate moving assuming that the coefficient of static friction between the crate and the floor is 0.54.
(Equations)


(9) Answer

(10) To move a large 35 kg crate across a rough floor, you push on it with a force at an angle of 22° below the horizontal, as shown the figure. Find the magnitude of the acceleration of the crate if the applied force is 330 N and the coefficient of kinetic friction is 0.42.

(Equations)

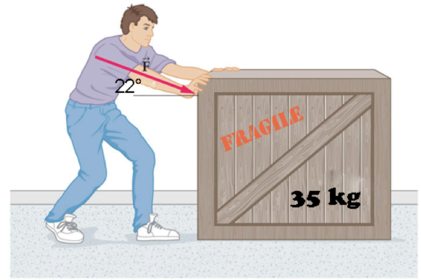

(10) Answer

(11, 12) To move a large 35 kg crate across a rough floor, you push on it with a force at an angle of 22° below the horizontal, as shown the figure. The coefficient of kinetic friction is 0.42. You push the box at a constant speed of 0.50 m/s

(11) Find the magnitude of force?

(12) Find the power needed.

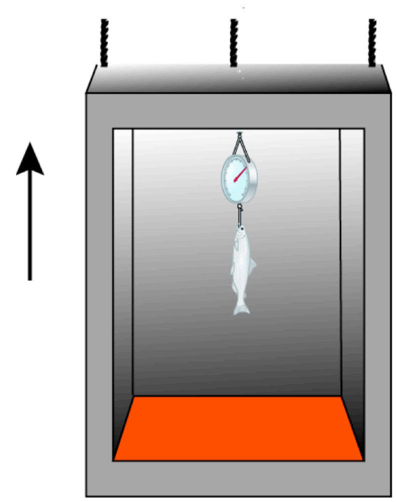
(Equations)



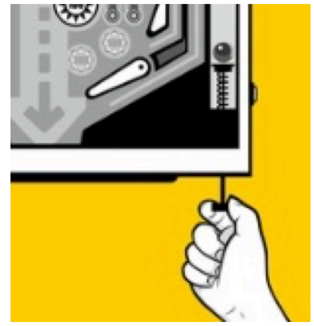

(11) Answer

(12) Answer

(13) A 4.55 kg salmon is hanged from a fish scale attached to the ceiling of an elevator. The elevator is moving upward and its speed is slowing down at acceleration rate of 2.60 m/s$^2$. What is the apparent weight of the salmon by kg as indicated by the scale?
(Equations)



(13) Answer



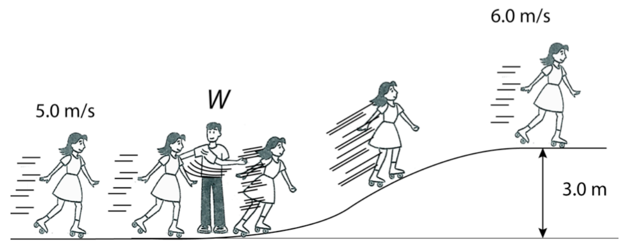
(14,15) A pinball has a spring with a force constant k = 408 N/m.
(14) Find the work by the elastic force required to compress 4.00 cm.

(15) After compressing the spring a distance of 4.00 cm, it hits a 255 g ball. Find the speed of the ball just after it leaves the spring.
(Equations)

| (14) Answer |
|---|
| |

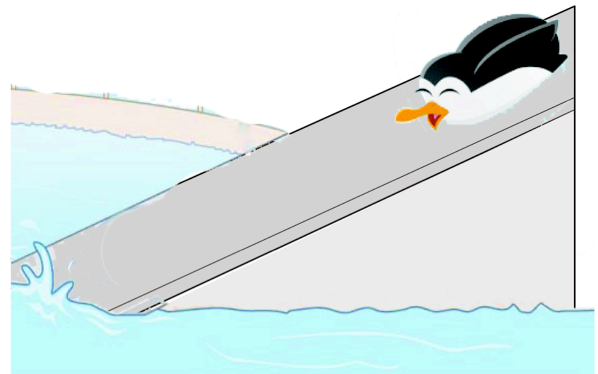
| (15) Answer |
|---|
| |

(16) A 55 kg skater is moving on a horizontal plane with a speed of 5.0 m/s. An instructor pushes her and then she moves up a 3.0 m high hill where her speed becomes 6.0 m/s. Find the work done by the instructor ignoring friction. (Equations)




(16) Answer

(17,18) A 22.0 kg penguin at an amusement park slides from rest down a ramp into the pool below. The top of the ramp is 1.55 m higher than the surface of the water, and the ramp is inclined at an angle of 31.0° above the horizontal. The penguin reaches the water with a speed of 3.40 m/s.
(17) Find the work done by kinetic friction.
(18) Find the coefficient of kinetic friction between the penguin and the ramp.
(Equations)



(17) Answer

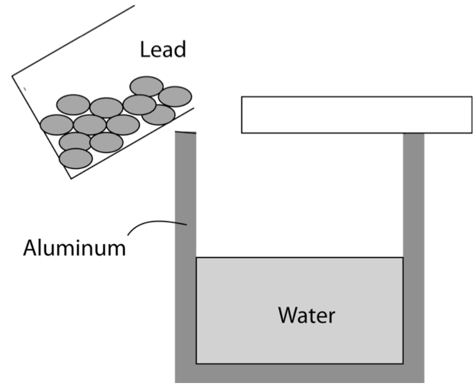
(18) Answer

(19) The temperature of 40 kg water in a bathtub is 48℃.  You want to make 42℃ bath by adding 10℃ water to the bathtub.  How much should you add?

(Equations)

(19) Answer

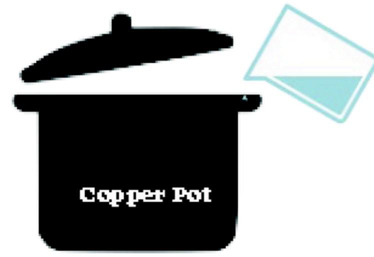
(20) Lead pellets of total mass 0.60 kg are heated to 100℃ and then placed in a well insulated aluminum cup of mass 0.20 kg that contains 0.50 kg of water initially at 17.3℃. What is the equilibrium temperature of the mixture?




(Equations)

(19) Answer

(21) A heavy copper pot of mass 2.0 kg is at a temperature of 150 ℃. You pour 0.10 kg of water at 25 ℃ into the pot, then quickly close the lid of the pot so that no steam can escape. Find the final temperature of the pot and its contents. If your answer is 100℃, determine the amount of water that has vaporized




(21) Answer

# Trigonometric Function Table

| 角 | 正弦 (sin) | 余弦 (cos) | 正接 (tan) |
|---|---|---|---|
| 0.0° | 0.0000 | 1.0000 | 0.0000 |
| 0.5° | 0.0087 | 1.0000 | 0.0087 |
| 1.0° | 0.0175 | 0.9998 | 0.0175 |
| 1.5° | 0.0262 | 0.9997 | 0.0262 |
| 2.0° | 0.0349 | 0.9994 | 0.0349 |
| 2.5° | 0.0436 | 0.9990 | 0.0437 |
| 3.0° | 0.0523 | 0.9986 | 0.0524 |
| 3.5° | 0.0610 | 0.9981 | 0.0612 |
| 4.0° | 0.0698 | 0.9976 | 0.0699 |
| 4.5° | 0.0785 | 0.9969 | 0.0787 |
| 5.0° | 0.0872 | 0.9962 | 0.0875 |
| 5.5° | 0.0958 | 0.9954 | 0.0963 |
| 6.0° | 0.1045 | 0.9945 | 0.1051 |
| 6.5° | 0.1132 | 0.9936 | 0.1139 |
| 7.0° | 0.1219 | 0.9925 | 0.1228 |
| 7.5° | 0.1305 | 0.9914 | 0.1317 |
| 8.0° | 0.1392 | 0.9903 | 0.1405 |
| 8.5° | 0.1478 | 0.9890 | 0.1495 |
| 9.0° | 0.1564 | 0.9877 | 0.1584 |
| 9.5° | 0.1650 | 0.9863 | 0.1673 |
| 10.0° | 0.1736 | 0.9848 | 0.1763 |
| 10.5° | 0.1822 | 0.9833 | 0.1853 |
| 11.0° | 0.1908 | 0.9816 | 0.1944 |
| 11.5° | 0.1994 | 0.9799 | 0.2035 |
| 12.0° | 0.2079 | 0.9781 | 0.2126 |
| 12.5° | 0.2164 | 0.9763 | 0.2217 |
| 13.0° | 0.2250 | 0.9744 | 0.2309 |
| 13.5° | 0.2334 | 0.9724 | 0.2401 |
| 14.0° | 0.2419 | 0.9703 | 0.2493 |
| 14.5° | 0.2504 | 0.9681 | 0.2586 |
| 15.0° | 0.2588 | 0.9659 | 0.2679 |
| 15.5° | 0.2672 | 0.9636 | 0.2773 |
| 16.0° | 0.2756 | 0.9613 | 0.2867 |
| 16.5° | 0.2840 | 0.9588 | 0.2962 |
| 17.0° | 0.2924 | 0.9563 | 0.3057 |
| 17.5° | 0.3007 | 0.9537 | 0.3153 |
| 18.0° | 0.3090 | 0.9511 | 0.3249 |
| 18.5° | 0.3173 | 0.9483 | 0.3346 |
| 19.0° | 0.3256 | 0.9455 | 0.3443 |
| 19.5° | 0.3338 | 0.9426 | 0.3541 |
| 20.0° | 0.3420 | 0.9397 | 0.3640 |
| 20.5° | 0.3502 | 0.9367 | 0.3739 |
| 21.0° | 0.3584 | 0.9336 | 0.3839 |
| 21.5° | 0.3665 | 0.9304 | 0.3939 |
| 22.0° | 0.3746 | 0.9272 | 0.4040 |
| 22.5° | 0.3827 | 0.9239 | 0.4142 |

| 角 | 正弦 (sin) | 余弦 (cos) | 正接 (tan) |
|---|---|---|---|
| 22.5° | 0.3827 | 0.9239 | 0.4142 |
| 23.0° | 0.3907 | 0.9205 | 0.4245 |
| 23.5° | 0.3987 | 0.9171 | 0.4348 |
| 24.0° | 0.4067 | 0.9135 | 0.4452 |
| 24.5° | 0.4147 | 0.9100 | 0.4557 |
| 25.0° | 0.4226 | 0.9063 | 0.4663 |
| 25.5° | 0.4305 | 0.9026 | 0.4770 |
| 26.0° | 0.4384 | 0.8988 | 0.4877 |
| 26.5° | 0.4462 | 0.8949 | 0.4986 |
| 27.0° | 0.4540 | 0.8910 | 0.5095 |
| 27.5° | 0.4617 | 0.8870 | 0.5206 |
| 28.0° | 0.4695 | 0.8829 | 0.5317 |
| 28.5° | 0.4772 | 0.8788 | 0.5430 |
| 29.0° | 0.4848 | 0.8746 | 0.5543 |
| 29.5° | 0.4924 | 0.8704 | 0.5658 |
| 30.0° | 0.5000 | 0.8660 | 0.5774 |
| 30.5° | 0.5075 | 0.8616 | 0.5890 |
| 31.0° | 0.5150 | 0.8572 | 0.6009 |
| 31.5° | 0.5225 | 0.8526 | 0.6128 |
| 32.0° | 0.5299 | 0.8480 | 0.6249 |
| 32.5° | 0.5373 | 0.8434 | 0.6371 |
| 33.0° | 0.5446 | 0.8387 | 0.6494 |
| 33.5° | 0.5519 | 0.8339 | 0.6619 |
| 34.0° | 0.5592 | 0.8290 | 0.6745 |
| 34.5° | 0.5664 | 0.8241 | 0.6873 |
| 35.0° | 0.5736 | 0.8192 | 0.7002 |
| 35.5° | 0.5807 | 0.8141 | 0.7133 |
| 36.0° | 0.5878 | 0.8090 | 0.7265 |
| 36.5° | 0.5948 | 0.8039 | 0.7400 |
| 37.0° | 0.6018 | 0.7986 | 0.7536 |
| 37.5° | 0.6088 | 0.7934 | 0.7673 |
| 38.0° | 0.6157 | 0.7880 | 0.7813 |
| 38.5° | 0.6225 | 0.7826 | 0.7954 |
| 39.0° | 0.6293 | 0.7771 | 0.8098 |
| 39.5° | 0.6361 | 0.7716 | 0.8243 |
| 40.0° | 0.6428 | 0.7660 | 0.8391 |
| 40.5° | 0.6494 | 0.7604 | 0.8541 |
| 41.0° | 0.6561 | 0.7547 | 0.8693 |
| 41.5° | 0.6626 | 0.7490 | 0.8847 |
| 42.0° | 0.6691 | 0.7431 | 0.9004 |
| 42.5° | 0.6756 | 0.7373 | 0.9163 |
| 43.0° | 0.6820 | 0.7314 | 0.9325 |
| 43.5° | 0.6884 | 0.7254 | 0.9490 |
| 44.0° | 0.6947 | 0.7193 | 0.9657 |
| 44.5° | 0.7009 | 0.7133 | 0.9827 |
| 45.0° | 0.7071 | 0.7071 | 1.0000 |

| 角 | 正弦 (sin) | 余弦 (cos) | 正接 (tan) |
|---|---|---|---|
| 45.0° | 0.7071 | 0.7071 | 1.0000 |
| 45.5° | 0.7133 | 0.7009 | 1.0176 |
| 46.0° | 0.7193 | 0.6947 | 1.0355 |
| 46.5° | 0.7254 | 0.6884 | 1.0538 |
| 47.0° | 0.7314 | 0.6820 | 1.0724 |
| 47.5° | 0.7373 | 0.6756 | 1.0913 |
| 48.0° | 0.7431 | 0.6691 | 1.1106 |
| 48.5° | 0.7490 | 0.6626 | 1.1303 |
| 49.0° | 0.7547 | 0.6561 | 1.1504 |
| 49.5° | 0.7604 | 0.6494 | 1.1708 |
| 50.0° | 0.7660 | 0.6428 | 1.1918 |
| 50.5° | 0.7716 | 0.6361 | 1.2131 |
| 51.0° | 0.7771 | 0.6293 | 1.2349 |
| 51.5° | 0.7826 | 0.6225 | 1.2572 |
| 52.0° | 0.7880 | 0.6157 | 1.2799 |
| 52.5° | 0.7934 | 0.6088 | 1.3032 |
| 53.0° | 0.7986 | 0.6018 | 1.3270 |
| 53.5° | 0.8039 | 0.5948 | 1.3514 |
| 54.0° | 0.8090 | 0.5878 | 1.3764 |
| 54.5° | 0.8141 | 0.5807 | 1.4019 |
| 55.0° | 0.8192 | 0.5736 | 1.4281 |
| 55.5° | 0.8241 | 0.5664 | 1.4550 |
| 56.0° | 0.8290 | 0.5592 | 1.4826 |
| 56.5° | 0.8339 | 0.5519 | 1.5108 |
| 57.0° | 0.8387 | 0.5446 | 1.5399 |
| 57.5° | 0.8434 | 0.5373 | 1.5697 |
| 58.0° | 0.8480 | 0.5299 | 1.6003 |
| 58.5° | 0.8526 | 0.5225 | 1.6319 |
| 59.0° | 0.8572 | 0.5150 | 1.6643 |
| 59.5° | 0.8616 | 0.5075 | 1.6977 |
| 60.0° | 0.8660 | 0.5000 | 1.7321 |
| 60.5° | 0.8704 | 0.4924 | 1.7675 |
| 61.0° | 0.8746 | 0.4848 | 1.8040 |
| 61.5° | 0.8788 | 0.4772 | 1.8418 |
| 62.0° | 0.8829 | 0.4695 | 1.8807 |
| 62.5° | 0.8870 | 0.4617 | 1.9210 |
| 63.0° | 0.8910 | 0.4540 | 1.9626 |
| 63.5° | 0.8949 | 0.4462 | 2.0057 |
| 64.0° | 0.8988 | 0.4384 | 2.0503 |
| 64.5° | 0.9026 | 0.4305 | 2.0965 |
| 65.0° | 0.9063 | 0.4226 | 2.1445 |
| 65.5° | 0.9100 | 0.4147 | 2.1943 |
| 66.0° | 0.9135 | 0.4067 | 2.2460 |
| 66.5° | 0.9171 | 0.3987 | 2.2998 |
| 67.0° | 0.9205 | 0.3907 | 2.3559 |
| 67.5° | 0.9239 | 0.3827 | 2.4142 |

| 角 | 正弦 (sin) | 余弦 (cos) | 正接 (tan) |
|---|---|---|---|
| 67.5° | 0.9239 | 0.3827 | 2.4142 |
| 68.0° | 0.9272 | 0.3746 | 2.4751 |
| 68.5° | 0.9304 | 0.3665 | 2.5386 |
| 69.0° | 0.9336 | 0.3584 | 2.6051 |
| 69.5° | 0.9367 | 0.3502 | 2.6746 |
| 70.0° | 0.9397 | 0.3420 | 2.7475 |
| 70.5° | 0.9426 | 0.3338 | 2.8239 |
| 71.0° | 0.9455 | 0.3256 | 2.9042 |
| 71.5° | 0.9483 | 0.3173 | 2.9887 |
| 72.0° | 0.9511 | 0.3090 | 3.0777 |
| 72.5° | 0.9537 | 0.3007 | 3.1716 |
| 73.0° | 0.9563 | 0.2924 | 3.2709 |
| 73.5° | 0.9588 | 0.2840 | 3.3759 |
| 74.0° | 0.9613 | 0.2756 | 3.4874 |
| 74.5° | 0.9636 | 0.2672 | 3.6059 |
| 75.0° | 0.9659 | 0.2588 | 3.7321 |
| 75.5° | 0.9681 | 0.2504 | 3.8667 |
| 76.0° | 0.9703 | 0.2419 | 4.0108 |
| 76.5° | 0.9724 | 0.2334 | 4.1653 |
| 77.0° | 0.9744 | 0.2250 | 4.3315 |
| 77.5° | 0.9763 | 0.2164 | 4.5107 |
| 78.0° | 0.9781 | 0.2079 | 4.7046 |
| 78.5° | 0.9799 | 0.1994 | 4.9152 |
| 79.0° | 0.9816 | 0.1908 | 5.1446 |
| 79.5° | 0.9833 | 0.1822 | 5.3955 |
| 80.0° | 0.9848 | 0.1736 | 5.6713 |
| 80.5° | 0.9863 | 0.1650 | 5.9758 |
| 81.0° | 0.9877 | 0.1564 | 6.3138 |
| 81.5° | 0.9890 | 0.1478 | 6.6912 |
| 82.0° | 0.9903 | 0.1392 | 7.1154 |
| 82.5° | 0.9914 | 0.1305 | 7.5958 |
| 83.0° | 0.9925 | 0.1219 | 8.1443 |
| 83.5° | 0.9936 | 0.1132 | 8.7769 |
| 84.0° | 0.9945 | 0.1045 | 9.5144 |
| 84.5° | 0.9954 | 0.0958 | 10.385 |
| 85.0° | 0.9962 | 0.0872 | 11.430 |
| 85.5° | 0.9969 | 0.0785 | 12.706 |
| 86.0° | 0.9976 | 0.0698 | 14.301 |
| 86.5° | 0.9981 | 0.0610 | 16.350 |
| 87.0° | 0.9986 | 0.0523 | 19.081 |
| 87.5° | 0.9990 | 0.0436 | 22.904 |
| 88.0° | 0.9994 | 0.0349 | 28.636 |
| 88.5° | 0.9997 | 0.0262 | 38.188 |
| 89.0° | 0.9998 | 0.0175 | 57.290 |
| 89.5° | 1.0000 | 0.0087 | 114.59 |
| 90.0° | 1.0000 | 0.0000 | – – – |

# Square and Root

| $n$ | $n^2$ | $\sqrt{n}$ |
|---|---|---|
| 1 | 1 | 1.0000 |
| 2 | 4 | 1.4142 |
| 3 | 9 | 1.7321 |
| 4 | 16 | 2.0000 |
| 5 | 25 | 2.2361 |
| 6 | 36 | 2.4495 |
| 7 | 49 | 2.6458 |
| 8 | 64 | 2.8284 |
| 9 | 81 | 3.0000 |
| 10 | 100 | 3.1623 |

Opinions, excuses etc.