Solve for the unknown variable.

TO SOLVE UNDER THE RADICAL...

STEP1 –Square both sides **STEP 2 –Cross multiply** **STEP 3 –Isolate the unknown**

1. $T = 2\pi\sqrt{\frac{3}{4}}$ _____

2. $2 = 2\pi\sqrt{\frac{d}{3}}$ _____

3. $5 = 2\pi\sqrt{\frac{3}{f}}$ _____

4. $6 = 2\pi\sqrt{\frac{8}{n}}$ _____

5. $d = 2\pi\sqrt{\frac{4}{6}}$ _____

6. $6 = 2\pi\sqrt{\frac{9}{c}}$ _____

7. $f = 2\pi\sqrt{\frac{2}{4}}$ _____

8. $t = 2\pi\sqrt{\frac{2}{9}}$ _____

9. $a = 2\pi\sqrt{\frac{2}{4}}$ _____

10. $4 = 2\pi\sqrt{\frac{d}{6}}$ _____

11. $6 = 2\pi\sqrt{\frac{3}{g}}$ _____

12. $7 = 2\pi\sqrt{\frac{8}{j}}$ _____

13. $8 = 2\pi\sqrt{\frac{9}{w}}$ _____

14. $2 = 2\pi\sqrt{\frac{8}{k}}$ _____

15. $3 = 2\pi\sqrt{\frac{4}{v}}$ _____

16. $t = 2\pi\sqrt{\frac{8}{3}}$ _____

17. $2 = 2\pi\sqrt{\frac{w}{4}}$ _____

18. $3 = 2\pi\sqrt{\frac{d}{6}}$ _____

19. $w = 2\pi\sqrt{\frac{8}{3}}$ _____

20. $f = 2\pi\sqrt{\frac{8}{2}}$ _____

21. $3 = 2\pi\sqrt{\frac{7}{f}}$ _____

22. $4 = 2\pi\sqrt{\frac{e}{4}}$ _____

23. $T = 2\pi\sqrt{\frac{9}{4}}$ _____

24. $6 = 2\pi\sqrt{\frac{k}{4}}$ _____

25 $9 = 2\pi\sqrt{\frac{5}{f}}$ _____

26. $5 = 2\pi\sqrt{\frac{9}{d}}$ _____

27. $3 = 2\pi\sqrt{\frac{s}{8}}$ _____

28. $3 = 2\pi\sqrt{\frac{5}{d}}$ _____

29. $c = 2\pi\sqrt{\frac{5}{9}}$ _____

30. $q = 2\pi\sqrt{\frac{4}{2}}$ _____

31. $6 = 2\pi\sqrt{\frac{d}{9}}$ _____

32. $4 = 2\pi\sqrt{\frac{5}{w}}$ _____

33. $f = 2\pi\sqrt{\frac{3}{8}}$ _____

34. $3 = 2\pi\sqrt{\frac{u}{7}}$ _____

35. $7 = 2\pi\sqrt{\frac{t}{4}}$ _____

36. $4 = 2\pi\sqrt{\frac{r}{12}}$ _____

37. $6 = 2\pi\sqrt{\frac{7}{s}}$ _____

38. $5 = 2\pi\sqrt{\frac{4}{y}}$ _____

39. $4 = 2\pi\sqrt{\frac{u}{9}}$ _____

40. $a = 2\pi\sqrt{\frac{2}{9}}$ _____

41. $c = 2\pi\sqrt{\frac{7}{4}}$ _____

42. $4 = 2\pi\sqrt{\frac{k}{3}}$ _____

43. $9 = 2\pi\sqrt{\frac{f}{3}}$ _____

44. $3 = 2\pi\sqrt{\frac{7}{e}}$ _____

45. $h = 2\pi\sqrt{\frac{5}{8}}$ _____

46. $w = 2\pi\sqrt{\frac{9}{4}}$ _____

47. $2 = 2\pi\sqrt{\frac{3}{g}}$ _____

48. $d = 2\pi\sqrt{\frac{12}{8}}$ _____

49. $y = 2\pi\sqrt{\frac{11}{3}}$ _____

50. $7 = 2\pi\sqrt{\frac{d}{9}}$ _____

51. $2 = 2\pi\sqrt{\frac{5}{z}}$ _____

FREQUENCY AND PERIOD CONVERSIONS

For the problems listed below, identify or calculate the period or frequency of motion. Express the frequency and the period STANDARD units.

52 A rock is swung around a child's head on a string 10 times in 30 seconds.

Period _____ Frequency _____

53 A roller coaster takes 0.5 seconds to complete a loop.

Period _____ Frequency _____

54 A spring board diver flips 3 times in 1.5 seconds.

Period _____ Frequency _____

55 An ice skater spins 20 times in 2 seconds.

Period _____ Frequency _____

56 A car tire rotates once every 0.1 seconds while traveling down the road.

Period _____ Frequency _____

57 A car motor turns 2000 revolutions per minute while traveling 25 mph.

Period _____ Frequency _____

58 A disk in a computer disk drive spins around once every 0.001 seconds.

Period _____ Frequency _____

59 A person on a swing goes back and forth every 2 seconds.

Period _____ Frequency _____

60 The front of a car rocks up and down after traveling over a bump 4 times in 2 seconds.

Period _____ Frequency _____

61 A percussionist bounces a drum stick 100 times in 2 seconds on a snare drum.

Period _____ Frequency _____

62 A “Tiger” takes 0.2 seconds between bounces while approaching Winnie the Pooh.

Period _____ Frequency _____

63 A toy gyroscope takes 0.09 seconds to spin around three times.

Period _____ Frequency _____

64 A stereo speaker takes 0.05 seconds to travel back and forth 5 times.

Period _____ Frequency _____

65 The keys on the typewriter are pressed every 0.3 seconds while typing a letter.

Period _____ Frequency _____

66 A church bell is rung once every 1.5 seconds.

Period _____ Frequency _____

67 60 pages in a book are read in 90 minutes.

Period _____ Frequency _____

68 1000 bubbles in soda-pop escape every 0.5 seconds when it is first poured.

Period _____ Frequency _____

69 While sharpening a pencil, the crank is turned once every 0.8 seconds.

Period _____ Frequency _____

70 Water drops drip out of a faucet once every 2.5 seconds.

Period _____ Frequency _____

71 A medieval knight swings a bolo around his head 10 times in 3 seconds.

Period _____ Frequency _____

72 While doing the discus, an athlete rotates 3 times in 1.5 seconds.

Period _____ Frequency _____

73 A baton is twirled 30 times in 1.5 seconds by a twirlette during a parade.

Period _____ Frequency _____

PENDULUMS

74 A pendulum swings back and forth on the Earth once every 3 seconds. What is the length of the pendulum arm?

75 A pendulum arm is 0.5 meters long. How long does it take to go back and forth once?

76 A pendulum is placed on another planet. The pendulum's arm is 2.0 meters long. The mass of the bob on the end is 0.30 kg. The time to swing back and forth once is 10 seconds. What is the acceleration due to gravity on this planet?

77 How long does a pendulum have to be to have a period of 1 second?

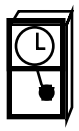
78 A child is swinging on a swing. The child takes 2 seconds to swing back and forth. The child's mass is 35 kg. How long are the ropes holding the swing up?

79 The pendulum arm on a clock is to swing back and forth once every 0.5 seconds. The bob on the end of the pendulum is 20 grams. How long does the pendulum arm need to be?

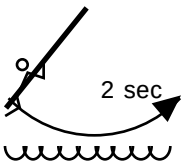
80 Tarzan swings on a vine in the jungle. He takes 3.0 seconds to swing across a river once. How long is the vine?

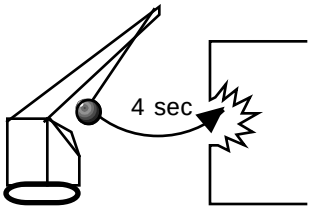
81 Fuzzy dice hang from the rear view mirror of a car. They swing back and forth once every 0.85 seconds. How long is the string the dice are attached to?

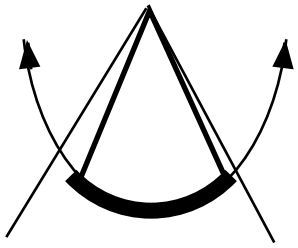
82 The fuzzy dice from the problem above are taken to another planet. On this other planet the dice swing back and forth every second. What is the acceleration due to gravity on this other planet?



83 A wrecking ball swings into a house. The ball takes 4 seconds to swing across the yard and into the side of a building. How long is the cable attached to the wrecking ball?

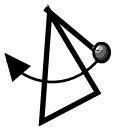






84 Kings Dominion has a ride called the "Berserker". The "Berserker" swings back and forth. The length of the arms attached to the "Berserker" are 30 m. How long does the "Berserker" take to swing from one side to the other?

85 The Yo-yo Man is doing a stunt with a yo-yo called “Rocking the Cradle.” The yo-yo swings on the end of a segment of string 25 cm long. How long does it take to swing back and forth once?



86 If the Yo-yo Man does this exact trick in the moon where the pull of gravity is 1.67 m/s^2. How long will it take for the yo-yo to swing back and forth once?

87 If the mass of the yo-yo is quadrupled and the trick is done on the Earth, then what will be its period of motion?

88 A traffic light is swinging from its cable. It takes 3.6 second to swing back and forth 3 times how long is the cable holding the traffic signal up.

89 A cat catches a mouse by the tail. Upon catching the mouse, the mouse proceeds to swing back and forth 5 times in 3.173 seconds. How long is the mouse’s tail?

90 In a science fiction story a civilization inhabits the Earth long before man. This civilization is constructing plans to build a pendulum that will swing from a space platform. The pendulum will swing back and forth once every hour. How long is the pendulum arm in meters and miles?

91. A pendulum has a pendulum arm of length 3.3 meters. What is the pendulum's period of motion on the Earth and on the Moon (g_m=1.67 m/s^2)?

92. What is the period of motion of a pendulum on the Earth that has an arm length of 0.5 meters?

93. What is the length of pendulum arm that has a period of motion of 1 hour?

94. Ned Numb-Skull took his pendulum clock with him to the moon. On the Earth the pendulum swung back and forth once every second. Was the clock faster or slower on the Moon than on the Earth? What was the period of motion on the moon?

95. A pendulum with an arm length of 2.25 m was taken to a spot on the Earth where the period of the pendulum is 3.44 seconds. What is the acceleration of gravity? Where do you think this spot might be?

RATIOS

96. Describe the effects on the period of motion when multiplying the mass on pendulum by 4.

97. Describe the effects on the period of motion when multiplying the length of a pendulum by 4.

98. Describe the effects on the period of motion when the gravitational pull on the pendulum is changed by a factor of 4.

99 Describe the effects on the period of motion when the pendulum's mass is tripled.

100 By what factor has the length on a pendulum bob changed if the period is doubled?

101 How has the acceleration due to gravity changed if the pendulum's period is held the same but its length has changed by a factor of 6?

102 By what factor has the length changed of a pendulum if the period has changed by a factor of $1/3$?

103 By what factor has the mass changed of a pendulum bob if the period has changed by a factor of 5?

104 By what factor has the period changed of a pendulum if the acceleration due to gravity is 6 times greater and the length is $1/2$ of what is was?

105 By what factor has the length changed of a pendulum if the acceleration due to gravity is 6 times greater and the period is $1/2$ of what is was?

106 By what factor has the length changed of a pendulum if the acceleration due to gravity is $1/2$ times what it was, the period is $1/2$ of what is was and the mass is doubled?

107 By what factor has the acceleration changed due to gravity if the length is doubled and the period has changed by a factor of 5?

108 By what factor has the period changed for a pendulum if the acceleration due to gravity is $1/2$ times what it was and the length is also $1/2$ of what is was?

SPRINGS

109. Define what a spring constant is:

110. Compare and contrast the properties of two springs; one with a high spring constant and the other with a low spring constant.

111. A spring is stretch 0.10 m by a 30 N force. What is its spring constant?

112. A spring with a spring constant of 12 N/m is stretched 30 cm. What is the restoring force of the spring?

113. How far is a spring stretched if it has a spring constant of 200 and is stretched by a 20 N force?

114. A spring is stretched 0.01 m by a 25 N force. What is its spring constant?

115. A spring with a spring constant of 8 N/m is stretched 30 cm. What is the restoring force of the spring?

116. How far is a spring stretched if it has a spring constant of 10 and is stretched by a 20 N force?

117. What is the period of motion of a spring with a spring constant of 200 N/m, if a 10 newton weight is attached to it?

118. A spring is observed to oscillate at 10 seconds/oscillation. A 30 N weight is attached to it. What is the spring's spring constant?

119. A spring with a spring constant of 20 N/m oscillates with a period of 2 sec. How much weight is attached to the spring?

120 A spring in compressed 0.10 m by a force of 10 N. What is the spring's force constant?

121 A spring is hung vertically from a horizontal beam. The spring is stretched 0.30 m by an object whose is weight of 50 N. What is the spring's force constant?

122 What force stretches a spring, with a force constant of 100 N/m, 0.3 meters?

123 How far is spring stretched by a 20 N force. The spring's force constant is 5 N/m.

124 A plastic slinky is stretched by a 3.0 N force. The slinky has a force constant of 4 N/m. How far did the slinky stretch?

125 A retractable ball point pen has a spring connected to its "clicker." The clicker moves 1 cm by a 8 newton force. What is the spring's spring constant?

126 A child's nerf gun toy is "souped up" by replacing the spring. The spring's force constant is 1000 N/m now. The spring is compressed by the nerf dart 10 cm. What force is required to compress the spring in the gun.

127 Kangaroo shoes are shoes with spring attached to the bottom of them. An 80 kg person compresses the springs on each shoe 2.5 cm. What is the spring's force constant on each shoe?

128 The spring in a pogo stick is compressed 8 cm by a 75 kg person. What is the spring's force constant in the pogo stick?

129 Many push button switches have springs behind them. The springs are what move the buttons to its original position after being pressed. The push button on/off switch on a car stereo moves 1 millimeter when pressed by a 2 N force. What is the spring's force constant for this button?

130 The sliding button on a disposable camera has a spring attached to it. How much force is required to move this spring if its force constant is 0.5 N/m and the switch moves 3 millimeters?

OSCILLATION

131 A spring is hanging from a post. It oscillates up and down 20 cm. It oscillates once every 0.5 seconds. If the mass attached to the end of the spring is 0.20 kg, then what is the spring's force constant?

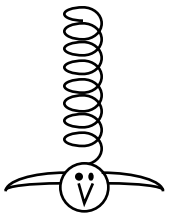
132 A spring with a force constant of 10 N/m is stretched 0.5 meters from its equilibrium position. The spring has a 2 kg mass attached to it. What is its period of motion?

133 A spring oscillates 10 times in 30 seconds. The spring's force constant is 100 N/m. What is the mass of the bob attached to the end of the spring?

134 A "Pogo Swing" is a 1.5 m long tube that has a spring attached to the top of it. The pogo swing attaches to a swing set in place of the swing. The user is allowed to bounce up and down. If the Pogo swing has a spring constant of 1000 N/m and the rider has a mass of 50 kg, then how long does it take to bounce up and down once?

135 In the 1970's there was a special toy that consisted of a 1 m long spring attached to the ceiling. On the other end of the spring was a heavy plastic bird. A person is supposed to pull stretch the spring down and let go. The bird would then oscillate up and down. What force constant is necessary for a 0.75 kg toy bird to oscillate once every 0.60 seconds?

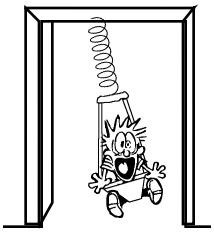
136 The shocks on a car have failed. Spring is also used to hold up the car. The car generally has 1 spring over each wheel. Therefore, the spring hold up, simplistically, 1/4 of the car's mass. The car is pressed down, and the car begins to bounce up and down on its springs. If it takes 0.33 seconds to for a 1200 kg car to oscillate up and down once, then what is the force constant on the spring?



137 A popular baby toy is called a "Johnny Jump Up." The Johnny Jump Up is a seat that a 12 month old would sit in. The seat is attached to a long spring that is connected to the frame of a door. If a 10 kg baby bounces up and down 10 times every 2 seconds, then what is the spring's force constant?

138 In a crazy stunt, a jeep is dropped off a bridge. The car is attached to a long spring. Once dropped, the car bounces up and down once every 5 seconds. If the car's mass is 2000 kg, then what is the spring's force constant?

139 A paddle ball is a small hand held paddle attached to a rubber ball by a 1 meter long piece of rubber. The elastic has a force constant of 10 N/m. If the ball's mass is 0.10 kg, then how long does it take for the ball to go up and down once?



1 5.44
2 0.30
3 4.74
4 8.77
5 5.13
6 9.87
7 4.44
8 2.96
9 4.44
10 2.43
11 3.29
12 6.44
13 5.55
14 78.96
15 17.55
16 10.26
17 0.41
18 8.21
19 10.26
20 12.57
21 30.71
22 6.48
23 9.42
24 14.59
25 2.44
26 14.21
27 14.59
28 21.93
29 4.68
30 8.89
31 73.86
32 12.34
33 3.85
34 11.17
35 19.86
36 58.36
37 7.68
38 6.32
39 32.83
40 2.96
41 8.31
42 3.65
43 18.47
44 30.71
45 4.97
46 9.42
47 29.61
48 7.70
49 12.03
50 100.54
51 49.35

52	3	0.33
53	0.5	2
54	0.5	2
55	0.10	10
56	0.1	10
57	3/100	33.3
58	1/1000	1000
59	2	0.5
60	0.5	2
61	1/50	50
62	0.2	5
63	3/100	33.3
64	0.01	100
65	0.3	3.33
67	90	1/90
68	0.005	2000
69	0.8	1.25
70	2.5	0.4
71	0.3	10/3
72	0.5	2
73	0.05	20

74 2.23 m
75 1.42 s
76 0.79 m/s^2
77 0.25 m
78 0.99 m
79 0.062 m
80 8.94 m
81 0.18 m
82 7.11 m/s^2
83 15.89 m
84 5.50 s
85 1.00 s
86 2.43 s
87 1.00 s mass has no effect on the period of motion for a pendulum
88 0.36 s
89 0.10 m
90 3,217,150 m: 1999.9 mi
91 $T_{(Earth)}$ = 3.65 s
$T_{(Moon)}$ = 8.83 s
92 1.42 s
93 3,217,150 m: 1999.9 mi
94 $T_{(Moon)}$ = 2.24 s
95 7.51 m/s^2: Way above the surface of the Earth. greater than mountains or passenger jets fly.
96 No effect
97 2
98 1/2
99 No effect
100 4
101 6
102 1/9
103 No idea. Mass does not affect by the length of a pendulum arm
104 $\sqrt{\frac{1}{12}}$
105 3/2
106 0.125 (1/8)
107 0.08 or 2/25
108 no change
109 Stiffness of the spring. Force to stretch it 1 meter
110 High Spring constant means a stiff spring that is more difficult to compress.
111 300 N/m
112 3.6 N
113 0.10 m
114 2500 N/m
115 2.4 N
116 2 m
117 0.45 s: (1.0204 kg)
118 1.21 N/m
119 19.8 N: (2.0264 kg)
120 100 N/m
121 166.67 N/m
122 30 N
123 4 m
124 0.75 m
125 800 N/m
126 100 N
127 15680 N/m
128 9187.5 N/m
129 2000 N/m
130 0.0015 N
131 31.58 N/m
132 2.81 s
133 22.80 kg
134 1.40 s
135 82.25 N/m
136 108,756 N/m
137 9869.6 N/m
138 3158.27 N/m
139 0.63 s