

1.)

Two bodies each having a mass of 450 milligrams are separated in space a distance of 10 km apart, what is the force exerted on each other due to gravitation?

Solutions

$$F = G \frac{M_1 M_2}{d^2}$$

$$= 6.67 \times 10^{-11} \left[\frac{[450 \times 10^{-6}] [450 \times 10^{-6}]}{[10,000]^2} \right]$$

$$F = 1.35 \times 10^{-25}$$

2.)

Solve for x in the question: $\text{Arc tan } 2x + \text{Arc tan } x = (\pi / 2) - 45^\circ$

Solutions

$$\text{Let: } A = \text{Arc tan } 2x \\ \tan A = 2x$$

$$B = \text{Arc tan } x \\ \tan B = x$$

$$\text{Arc tan } 2x + \text{Arc tan } x = (\pi / 2) - 45^\circ$$

$$A + B = 90^\circ - 45^\circ$$

$$A + B = 45^\circ$$

Take tangent on both sides:

$$\tan (A + B) = \tan 45^\circ$$

$$\frac{\tan A + \tan B}{1 - \tan A \tan B} = 1$$

$$\tan A + \tan B = 1 - \tan A \tan B$$

$$2x + x = 1 - 2x(x)$$

$$3x = 1 - 2x^2$$

$$2x^2 + 3x - 1 = 0$$

Using the formula:

$$x = \frac{3 \pm \sqrt{(3)^2 - 4(2)(-1)}}{2(2)} = \frac{-3 \pm 4.123}{4}$$

$$x = \frac{-3 + 4.123}{4} = 0.281$$

$$x = \frac{-3 - 4.123}{4} = -1.781$$

3.)

If $84^\circ - 0.4x = \text{Arc tan}(\cot 0.25x)$, find x .

Solutions

$$84^\circ - 0.4x = \text{Arc tan}(\cot 0.25x)$$

$$\tan(84^\circ - 0.4x) = \cot 0.25x$$

Since the tangent and the cotangent functions are equal, thus two angles are complimentary.

$$(84^\circ - 0.4x) + 0.25x = 90^\circ$$

$$0.15x = 6^\circ$$

$$x = 40^\circ$$

