Week Forty-four problems and solutions

Question 1.

The weight of an object on Venus is approximately 9/10 of its weight on Earth. The weight of an object on Jupiter is approximately 23/10 of its weight on Earth. If an object weighs 100 Newtons on Earth, approximately how many more Newtons does it weigh on Jupiter than it weighs on Venus?

Solution

Let e, j, v be the weight of an object on the Earth, Jupiter, and Venus respectively
v = 9/10 e = 9/10 x 100 = 90 Newtons
j = 23/10 e = 23/10 x 100 = 230 Newtons
j – v = 230 – 90 = 140 Newtons heavier on Jupiter than Venus

Question 2.

Between 1497 and 1500, Amerigo Vespucci embarked on two voyages to the New World. According to Vespucci's letters, the first voyage lasted 43 days longer than the second voyage, and the two voyages combined lasted a total of 1,003 days. How many days did the second voyage last?

Solution

Suppose that the second voyage lasted s days.
The number of days the first voyage lasted is then s + 43.
Since the two voyages combined lasted a total of 1,003 days,
then (s + 43) + s = 1,003, namely, 2s + 43 = 1,003, 2s = 960,
hence, the second voyage length, s = 480 days.

Question 3.

A garrison of 1075 men could exist on full rations for 30 days. After 16 days on full rations the garrison is augmented by 129 men and, at the same time, the stock of the existing provisions is increased by 60% by means of parachute supplies. How much longer can the augmented garrison hold out on half rations?

Solution

Supplies at the start are: 1075 x 30 rations

But after 16 days, they are down to: 1075 x 14 full rations.

They are boosted by 60% up to: 1.6 x 1075 x 14 full rations.

= 2 x 1.6 x 1075 x 14 = 48160 half rations

The number of soldiers is now 1075 + 129 = 1204

Supplies will last 48160 / 1204 = 40 days

Question 4.

What values of x and y satisfy the following pair of equations:

$2x – y + 4 = 0$

$4x^2 + 2xy + 15y – 21 = 0$

Solution

From first equation $y = 2x + 4$

Substitute in the second one:

$4x^2 + 2x(2x + 4) + 15(2x + 4) – 21 = 0$

$8x^2 + 38x + 39 = 0$

So, using the quadratic formula for $ax^2 + bx + c = 0$ of $x = (-b \pm \sqrt{(b^2 – 4ac)}) / (2a)$

$x = (-38 \pm \sqrt{(1444 – 4.8.39)}) / 16 = (-38 \pm 14) / 16$

Hence $x = -(3/2)$ and $y = 1$ or $x = -(13/4)$ and $y = -(5/2)$