Lincoln Sand

I1.

226.2:

We look for a number x such that x^2 is less than or equal to 1428. Here, $x = 37$, $37^2 = 1369$. We have a remainder of 59.

Bring down the next pair to get 5984.

Double 37 to get $p = 74$. We will find an x such that $(740 + x) \cdot x$ is less than or equal to 5984. $x = 8$ with $748 \cdot 8 = 5984$. Subtract the result to get a remainder of 0.

Append 8 to 37 to get 378.

The square root of 142884 is 378.

226.3:

Find x such that $x^2 \leq 12$, so $x = 3$. Subtract 9 from 12 to get a remainder of 3.

Bring down the next pair to get 381.

Double 3 to get 6. Find x such that $(60+x)\cdot x \leq 381$. So, $x = 5$, giving $65 \cdot 5 = 325$. Subtract 325 from 381 to get a remainder of 56. Append 5 to 3 to get 35.

Bring down the next pair to get 5629.

Double 35 to get 70. Find x such that $(700 + x) \cdot x \leq 5629$. So, $x = 7$ giving $707 \cdot 7 = 4949$. Subtract 4949 from 5629 to get a remainder of 680. Append 7 to 35 to get 357.

Bring down the last pair to get 68004.

Double 357 to get 714. Find x such that $(7140 + x) \cdot x \leq 68004$. So, $x = 9$ because $7149 \cdot 9 = 64341$. Subtract 64341 from 68004 to get a remainder of 3663. Append 9 to 357 to get 3579.

Thus, the square root of 12812904 is 3579 with remainder 3663.

226.6:

We will convert these into number of reservoirs filled per day.

$R_1 = 3$, $R_2 = 1$, $R_3 = \frac{2}{5}$, $R_4 = \frac{1}{3}$, $R_5 = \frac{1}{5}$.

Combined rate $= \frac{74}{15}$ reservoirs per day.

Thus, the time to fill one reservoir is $\frac{15}{74}$ days.

226.8:

$$s_6 = \sqrt{\frac{3}{4}}$$

$$s_{2n} = \sqrt{\frac{1}{2} - \sqrt{\frac{1}{4} - \left(\frac{s_n}{2}\right)^2}}$$

$$S_{2n} = 2n \cdot s_{2n}$$

So,

$$S_6 = 5.196152422706632$$

$$S_{12} = 6.0$$

$$S_{24} = 6.2116570824605$$

$$S_{48} = 6.265257226562474$$

$$S_{96} = 6.278700406093744$$

226.16:

Let's denote the side of the square city as s. The diagonal d of the square city can be calculated using $d = s\sqrt{2}$.

So, the total path the person views the tree from can be expressed as $d + 20$ and using the Pythagorean theorem:

$$(s+14)^2 + 1775^2 = (d+20)^2$$
$$(s+14)^2 + 1775^2 = (s\sqrt{2}+20)^2$$

Solving for s gives $-20\sqrt{2} + 14 + \sqrt{3151417 - 560\sqrt{2}} \approx 1760.72$ pu.

226.18:

Consider the triangles KEF and KCD, so $\frac{\text{KE}}{\text{KC}} = \frac{\text{FE}}{\text{DC}}$.

Plugging in the values gives:

$$\text{DC} = 10 + \frac{3}{4}\text{EC}$$

Consider the triangles GEH and GCD, so $\frac{\text{GE}}{\text{GC}} = \frac{\text{FE}}{\text{DC}}$.

Plugging in the values gives:

$$600\text{DC} = 453\text{EC} + 2265$$

Plugging the first equation into the second gives:

$$\text{EC} = 1245$$

Plugging this back in gives:

$$\text{DC} = 943\frac{3}{4}$$

226.19:

We can turn this into a system of equations.

Let x be a unit of good grain, let y be a unit of ordinary grain, and let z be a unit of worst grain.

$$2x + 1y = 1$$
$$3y + 1z = 1$$
$$4z + 1x = 1$$

Solving this gives: $x = \frac{9}{25}$, $y = \frac{7}{25}$, $z = \frac{4}{25}$.

I2. Essay on Renaissance Mathematics

Lincoln Sand

Working title: Bhaskara II and the Foundations of Calculus

Essay topic description:

I want to write an essay about Bhaskaracharya's concepts of instantaneous motion, especially since it predated Newton and Leibniz. I want to explore his work with infinitesimals.

Interesting fact:

His work contained much of the elements and intuitions of modern integral calculus, yet it predated its traditional discovery by Newton and Leibniz by several centuries. He invented an early form of Rolle's theorem.

Style manual I will use:

MLA

Two internet references:

1.

Bhāskara II: The great indian mathematician. Cuemath. (n.d.). https://www.cuemath.com/learn/bhaskara-ii/

2.

Encyclopædia Britannica, inc. (n.d.). Bhāskara II. Encyclopædia Britannica. https://www.britannica.com/biography/Bhaskara-II

1.

Datta, B. and A. N. Singh. Use of Calculus in Hindu Mathematics. Indian Journal of History of Sciences 19.2 (1984): 95–104.

2.

Srinivasiengar, C. N. The History of Ancient Indian Mathematics. Calcutta: World Press, 1967.

NOTE: I may end up changing my book references later.