

Franklin Mountains Activities

Have fun with math!

All the dimensions have been given in English system units. Let's convert English system units to metric units.

1. What's the elevation of North Franklin Mountain in meters?

Hint: Collect your data. Go to Franklin Mountains and find the elevation in feet, then remember that 1 foot equals 0.3048 meter.

2. If the Franklin Mountains are 23.2 kilometers long, how long are they in miles?

Hint: 1 kilometer equals 0.621 mile.

3. If the City of El Paso drills a water well in the Hueco Bolson that is 300 feet deep, how deep is the well in meters?

Hint: 1 meter equals 3.28 feet. (Be careful!)

4. The elevation of El Paso International Airport is 3,958 feet. Assume you are a pilot. If you take off in a small plane from the airport and you plan to fly over the top of North Franklin Mountain (see Franklin Mountains), what is the minimum amount of elevation you must gain to avoid crashing into the mountain?

5. Assume you are a geologist, and from your studies of one of the bounding faults on the Franklin Mountains you have determined that, on average, the fault has a major earthquake event every 20,000 years, the fault slips 20 feet in each major earthquake, and the total amount of slip along the fault is 7,500 feet. Assuming the frequency of fault events has been constant over time,

(a) how many earthquakes at 20 feet per event have occurred?

(b) How long has it taken for 7,500 feet of total slip to occur?

(c) What is the average slip per year?

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6. Let's go for a hike. Let's assume you are going to hike up the crest of the Franklin Mountains and that the ranger told you it's a moderately steep trail and that it is 2 miles from where you park your car and start walking to the ridge crest. You are in pretty good shape, but perhaps one of your friends is a slow walker. Because it's uphill, you can perhaps hike 1 mile every 35 minutes, and you plan on two 10-minute rest stops. Once you get to the ridge you plan on stopping for a picnic lunch for 45 minutes. You return by the same trail, but this time it's downhill so you expect to hike 1 mile every 25 minutes and you again take two 10-minute rest stops.

- (a) If you start walking at 11:00 a.m., when will you get to the ridge crest to stop for lunch?
- (b) When will you get back to your car?
- (c) Excluding lunch, what is your average hiking speed, including rest stops, in miles per hour for the total hike?

7. How much does that rock weigh?

Even if they are the same size, some rocks weigh more than others. A block of ash from a volcano, for example, may have lots of spaces in it that are filled with air, so it weighs less than a block of granite that's the same size. Most of the rocks in the Franklin Mountains will weigh about 1 ton per 14 ft³ ("cubic feet") of rock. If you find a block of rock that is 2 ft wide by 2 ft long by 3.5 ft tall ($2\text{ ft} \times 2\text{ ft} \times 3.5\text{ ft} = 14\text{ ft}^3$) it would weigh 1 ton, or 2,000 pounds.

- (a) If a block of rock that is 14 ft³ in volume weighs 2,000 pounds, how much does a block of rock weigh that is 7 ft³ in volume?
- (b) How much does a 1-ft³ block weigh? Could you lift a 1-ft³ block of rock?
- (c) How many tons, or how many pounds, does a large boulder weigh that is 2 ft wide by 5 ft long by 7 ft high?
When you are in the Franklins find a large block of rock. Estimate its dimensions: approximate width, length, and height. It's OK not to be precise, but try to make good guesses. Multiply to get an estimate of its volume, then use 14 ft³ per ton to make an estimate of its weight.

8. In the Franklin Mountains link, we said the Franklin Mountains are about 14 miles long and about 3 miles wide, and they rise about 3,000 feet high above the valleys. Using these dimensions estimate the volume of rock in the Franklin Mountains in cubic miles.

Hint: There are several ways to solve this problem, but you have to use a little geometry. Assume that the mountains are a perfect prism lying in the desert, with no canyons and no irregular peaks. From either end, the prism looks like an isosceles triangle that is 3,000 ft high and has a base that is 3 miles across. The area of a triangle is $\frac{1}{2}$ the base times the height. A mile is 5,280 ft long.

Franklin Mountains Activities Answer Sheet

1. The elevation of North Franklin Mountain is 7,192 ft. $7,192 \text{ ft} \times 0.3048 \text{ m/ft} = 2,192 \text{ meters}$ ($\text{ft} \times \text{m/ft} = \text{m}$)
2. The length is $23.2 \text{ km} \times 0.621 \text{ mi/km} = 14.4 \text{ miles}$ ($\text{km} \times \text{mi/km} = \text{mi}$).
3. Well depth = 300 ft and there are 3.28 ft/1 m (or 1 m/3.28 ft). In order to get an answer in feet, to keep units correct, $\text{m/ft} \times \text{ft} = \text{m}$, so $1 \text{ m}/3.28 \text{ ft} \times 300 \text{ ft}$, or $300 \text{ ft}/3.28 \text{ ft} = 91.5 \text{ m}$ deep.
4. $7,192 \text{ ft}$ (elevation of mountain peak) – $3,958$ (elevation of airport) = $3,232 \text{ ft}$.
5. (a) If total fault slip (displacement) is 7,500 ft, and the amount of slip per earthquake is 20 ft, then the total number of large earthquakes is 7,500 ft divided by 20 ft per event, or 375 earthquakes.
 (b) If major earthquakes occur every 20,000 years, and there were 375 earthquakes to produce the total displacement, the total time is $20,000 \text{ years/earthquake} \times 375 \text{ earthquakes} = 7,500,000 \text{ years}$ (7.5 million years).
 (c) If the total slip is 7,500 ft and the total time is 7,500,000 years, then the average feet per year is 7,500 ft divided by 7,500,000 years, or 0.001 ft per year.
6. (a) Hike up to ridge = $35 \text{ minutes/mile} \times 2 \text{ miles}$ (70 minutes) + 2 rest stops $\times 10 \text{ minutes}$ (20 minutes) = 90 minutes to hike to the ridge. If you leave your car at 11:00 a.m., you will arrive at the ridge crest at 11:00 a.m. + 90 minutes, or 12:30 p.m.
 (b) You picnic for 45 minutes and hike down from the ridge 2 miles at 25 minutes per mile (50 minutes) + two rest stops of 10 minutes (45 minutes + 50 minutes + 20 minutes = 115 minutes, or 1 hour and 55 minutes). You will return to your car at 12:30 p.m. + 1 hour and 55 minutes, or 2:25 p.m.
 (c) Your average hiking speed in miles per hour (excluding lunch) is time hiking up (90 minutes) per 2 miles + time hiking down (70 minutes) per 2 miles, or 160 minutes per 4 miles. $160 \text{ minutes} / 4 \text{ miles} = 40 \text{ minutes per mile}$ average hiking speed, or 1.5 miles per hour ($1 \text{ mile} / 40 \text{ min} = X \text{ miles}/60 \text{ min}$; $60 \text{ min}/40 \text{ min} = 1.5 \text{ miles/hour}$)
7. (a) Remember, a 14-ft^3 block of rock weighs 2,000 pounds. If you think about it, 7 ft^3 is $\frac{1}{2}$ of 14 ft^3 , so the block would weigh $\frac{1}{2}$ of 2,000 pounds, or 1,000 pounds, OR $2,000 \text{ lb}/14 \text{ ft}^3 = X \text{ lb}/7 \text{ ft}^3$, or $7 \text{ ft}^3 \text{ } 2,000 \text{ lb}/14 \text{ ft}^3 = X$. Therefore $X = 2,000 \text{ lb}$ divided by 2, or 1,000 lb.
 (b) A 1-ft^3 block weighs $1/14 \times 2,000$ pounds, or 143 pounds. Can you lift it?
 (c) The volume of the boulder is $2 \text{ ft} \times 5 \text{ ft} \times 7 \text{ ft}$, or 70 ft^3 ; the weight is volume (70 ft^3) divided by $14 \text{ ft}^3 \times 2,000 \text{ pounds}$. $5 \times 2,000 \text{ lb} = 10,000 \text{ pounds}$. (5 tons)
8. First make sure all your dimensions are in the same units. Height = 3,000 ft; width = 3 miles; length = 14 miles. Convert 3,000 ft to miles; $3,000 \text{ ft}/5,280 \text{ ft} = 0.568 \text{ mile}$. Because this is an estimate, let's keep it simple; round off to 0.6 mile. Next, calculate the area of the triangle that approximates a section cut across the mountains: $\frac{1}{2} \text{ base} \times \text{height} = \text{area}$ or $(\frac{1}{2}) (3 \text{ miles}) \times 0.6 \text{ mile} = 1.5 \text{ mi} \times 0.6 \text{ mi} = 0.9 \text{ mi}^2$ (square miles). That's the tough part. The total volume of the Franklin Mountains is the length of the mountains times the cross-sectional area, or $0.9 \text{ mi}^2 \times 14 \text{ mi}$ or 12.6 mi^3 (cubic miles). That's a lot of rock.