FFA State Finals: 2019
Ag. Mechanics: Problem Solving

Instructions: Verify your contestant number on the Scantron form issued by the proctor. Examine each of the three sets of plans provided. Consider the questions pertaining to each, and record your answers on the Scantron. Scratch paper is provided for your calculations.

Utility Deck Plan Questions:

1. What is the cut length for the 2x6 deck planks?
    a. 15'8"
    b. 16'0"
    c. 17"
    d. 20'

2. If the lumberyard only carries 8' pressure treated 4x4's, how many should you order?
    a. 1
    b. 2
    c. 3
    d. 4

3. How many pier blocks need to be ordered?
    a. 1
    b. 3
    c. 6
    d. 9
    e. Not enough information given.

4. What is the exact length of the 4 x 8's?
    a. 15'
    b. 16'
    c. 15'- 8"
    d. 15' - 5"

5. What is the width of each deck plank?
    a. 2"
    b. 6"
    c. 5-1/4"
    d. 5-1/2"

6. How many deck planks (redwood) are required?
    a. 32
    b. 33
    c. 34
    d. 35

7.   What is the exact length of the floor joists?
        a. 8'
        b. 7' 10-1/2"
        c. 90-3/4"
        d. 96"
        e. Both a and d above.

8.   What is the cost of the pier blocks (tax included, @ 7.75%)? The price tag on each pier block at Home Depot says $8.59.
        a. $8.59
        b. $77.31
        c. $83.30
        d. $7.75

9.   What is the cost of the main beams (tax included, @ 7.75%; Doug Fir lumber cost is $2.21/BF)?
        a. $295.28
        b. $233.60
        c. $221.00
        d. $274.04

10.   What is the cost of the redwood planks (tax included @ 7.75%; Con Heart Redwood cost is $1560/M)?
        a. $848.64
        b. $914.41
        c. $628.66
        d. $1680.09

Concrete Containment Slab (Fuel Tank Installation):

11.   What is the volume of the slab only (dimensions inside containment wall)?
        a. 170.5 ft^3
        b. 100 ft^3
        c. 150 ft^3
        d. 114 ft^3

12.   If concrete was priced at $110/yd^3, how much would 100 ft^3 cost (including tax at 8.75%)?
        a. $108.75
        b. $443.06
        c. $962.50
        d. $3333.00

13.   What is the entire volume of concrete?
        a. 252.5 ft^3
        b. 196 ft^3
        c. 233 ft^3
        d. 232 ft^3

14. What is diameter of the rebar?
    a. 4"
    b. 4/12"
    c. ½"
    d. ¼"

15. The drawing calls for a number of 10' long pieces of rebar (neglecting pieces required to connect the ends). How many?
    a. 12
    b. 22
    c. 28
    d. 10
    e. 14

16. The drawing calls for a number of 20' long pieces of rebar (neglecting pieces required to connect the ends). How many?
    a. 12
    b. 22
    c. 20
    d. 18

17. How much fuel can this containment structure handle?
    a. 300 ft³
    b. 400 ft³
    c. 3366 gallons
    d. 4000 gallons

Questions 18-21 are based on the following assumptions:
    Concrete volume = 2.5 yd³
    For transit mixed/delivered, order 10% extra
    For site-mixed concrete:
    Use 6 sack mix (6 sacks cement/yd³ of concrete, 1 to 2.4 to 2.8 cement/sand/gravel ratio
    Water/cement ratio = 5 gal/sack.
    Order 15% extra materials.

18. For transit mixed/delivered, how much concrete should be ordered?
    a. 2.5 yd³
    b. 2.75 yd³
    c. 2.73 yd³
    d. 27 ft²

19. For site-mixed concrete, how much cement should be ordered?
    a. (18) 94 lb sacks
    b. (17) 94 lb sacks
    c. (15) 94 lb sacks
   d. (6) 94 lb sacks

20. For site-mixed concrete, how much sand should be on-hand?
   a. 17.25 yd^3
   b. 1.53 yd^3
   c. 1.53 ft^3
   d. 14.4 ft^3

21. For site-mixed concrete, how much gravel should be on-hand?
   a. 7 ft^3
   b. 42 ft^3
   c. 1.79 yd^3
   d. 30 ft^3

Land Measurement Questions:

22. A field must be lowered by 0.5 feet for irrigation purposes. If the field is 150 feet by 250 feet, how many cubic yards will be removed?
   a. 350 cubic yards
   b. 526 cubic yards
   c. 694 cubic yards
   d. 1389 cubic yards
   e. 1875 cubic yards

23. A trapezoidal field has a base of 1000 feet on one side and 800 feet on the other side. The perpendicular distance between the two sides is 500 feet. What is the area of the field?
   a. 400,000 sq. feet
   b. 450,000 sq. feet
   c. 500,000 sq. feet
   d. 550,000 sq. feet
   e. 600,000 sq. feet
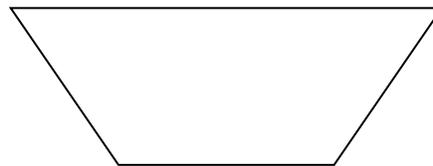
24. A laser level is used to measure the slope of a field that is 5280 feet long. It is set up and a reading of 1.50' is taken at the north edge of the field, then a reading on a water valve of 6.33' is taken. The laser level is moved and a new reading on the valve of 2.25' is taken and then a reading of 8.17' on the south end of the field is taken. What is the slope from north to south end of the field?
   a. +0.40 %
   b. +0.20 %
   c. -0.40 %
   d. -0.20%
   e. -0.05%

25. What is the Contour interval of the map.
    a. 200 feet
    b. 2 feet
    c. 20 feet
    d. 40 feet
    e. Cannot be determined

26. What is the slope from point "A" to Point "B"
    a. 5.65%
    b. 12.3%
    c. 14.8%
    d. -13.5%
    e. Depends on the scale

27. What does the dotted line labeled "C" represent?
    a. Contour Interval
    b. Paved road
    c. Dirt Road
    d. Flow Line
    e. Limit of the Gravel Pit
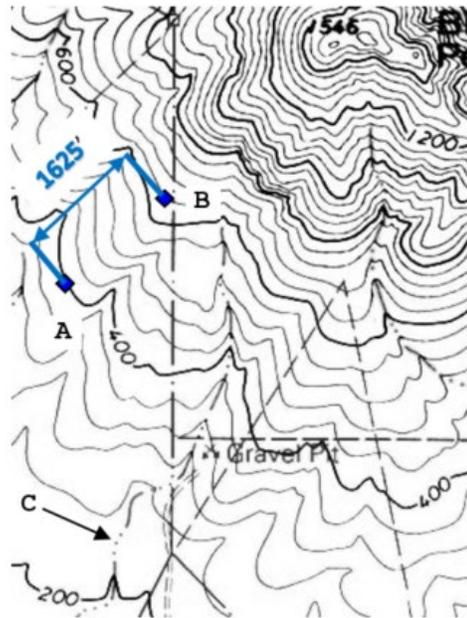
28. The image below shows level rod readings across a canal. What is the approximate cross-sectional area of the canal at 12+25? If the Left top of bank was at an elevation of 100.00 feet, what would the right Toe elevation be?

Station 12+25
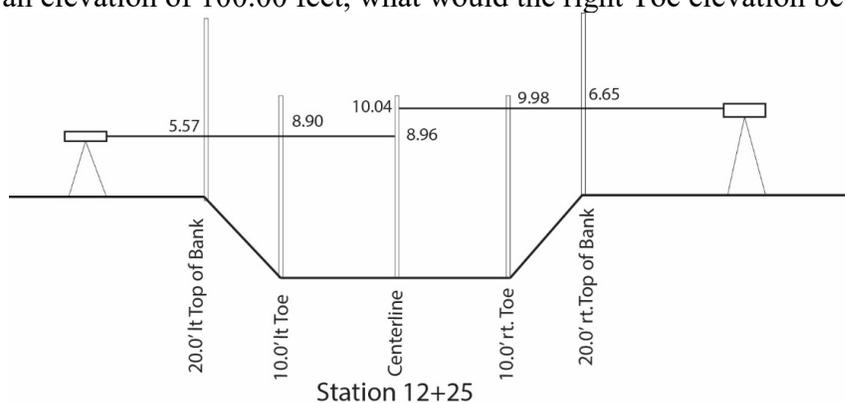
    a. 96.67 feet
    b. 96.61 feet
    c. 89.98 feet
    d. 105.57 feet
    e. Not enough information

29. On the previous image, what is the slope from the left toe to the centerline?
    a. -0.60%
    b. -1.20%
    c. 0.60%
    d. 1.20%
    e. -6.0%

30. One end of a field has an elevation of 252.1' the other end has an elevation of 241.6'. If the field is 300' long what is the slope of the field?
    a. 1.5 %
    b. 2.0 %
    c. 2.5 %
    d. 3.5 %
    e. 7.1 %

31. A field is to be land leveled to a -0.35% slope from North to South. If the Southeast corner has an elevation of 1256.3 feet, and the distance from the Southeast corner to the Northeast corner is ¼ mile (1 mile = 5280 feet) due North from the Southeast corner. What should the final elevation at the Northeast corner be?
    a. 1249.59 feet
    b. 1251.68 feet
    c. 1252.76 feet
    d. 1258.93 feet
    e. 1260.92 feet