1. If the percent grade is 7.25 % and the horizontal length of grade is 1625 feet, what is the change in elevation?
    a. 117.81 feet
    b. 1178.13 feet
    c. 11.78 feet
    d. 1.17 feet

2. In surveying, the distance between two points means the
    a. Horizontal or level distance
    b. Slope distance
    c. Vertical distance between two the points
    d. Distance measured with a string line

3. Which of the following survey equipment would be acceptable to use to set finish grade stakes?
    a. Level and Rod
    b. Transit
    c. Laser Level
    d. All of the above

4. Given the following determine the percent grade of the slope:

    Elev. A = 200.05, Elev. B = 325.25, horizontal distance = 1625 feet
    a. 7.7
    b. .077
    c. 12.98
    d. 1.28

5. Unless the contract states otherwise, the Project Engineer is responsible for:
    a. Nothing
    b. Providing all surveying needed to locate and define the contract work
    c. Clearing stakes
    d. One bench mark

6. Given a manhole with the outlet invert elevation of 2605. A run of 48 inch pipe connects to the next manhole at an invert elevation of 2610. What is the distance between manholes if the correct pipe grade is 3%?
    a. 16.67 feet
    b. 166.67 feet
    c. 150 feet
    d.   155.5 feet

7. Convert the following angle in decimal form, 36.1450 degrees to degrees, minutes and seconds.
   a. 36 degrees, 2 min. 4 sec.
   b. 36 degrees, 0 mi. 2 sec.
   c. 36 degrees, 8 min, 42 sec.
   d. 36 degrees, 6 deg. 2 sec.

8. A good rule of thumb to follow when leveling is:
   a. Set up the instrument over a known elevation
   b. Set up the instrument within 300 feet of all points to be surveyed
   c. On the best smooth level surface
   d. Set up the instrument in order to see both the highest point and lowest point on the loop.

9. A transit is setup at the top of a slope to measure the slope angle. A hub is shot at the bottom of the hill. How is the horizontal distance measured?
   a. It is calculated using trigonometry and the measured slope distance
   b. The distance is measured between the two hubs with a tape.
   c. Between the axis of the transit and the hub
   d. None of the above

10. Which of the following statements about pacing is true:
    a. Requires no equipment and should be completed with natural steps.
    b. Is only of value to a surveyor with an instrument
    c. A person should pace in an attempt to make 33 steps per 100 ft.
    d. A persons pace should be adjusted to an even 3 feet length

11. The following data was obtained with the level. What is the HI of the instrument

| Sta.	B.S.	H.I.	F.S.	ELEV
BM	5.23			95.24
TP1	7.53		3.57	
TP2			2.15	

   a. 88.20
   b. Can not be calculated with the information given
   c. 100.47
   d. 90.01

12. The following data was obtained with the level. What is the elevation of 259+00

Sta.	B.S.	H.I.	F.S.	ELEV
BM	8.25			83.27
259+00			2.35	
259+50			2.12	
300+00			1.97	

    a. 89.17
    b. 76.99
    c. 81.46
    d. 89.55

13. The plans show the following typical section. Calculate the elevation at the edge of shoulder.
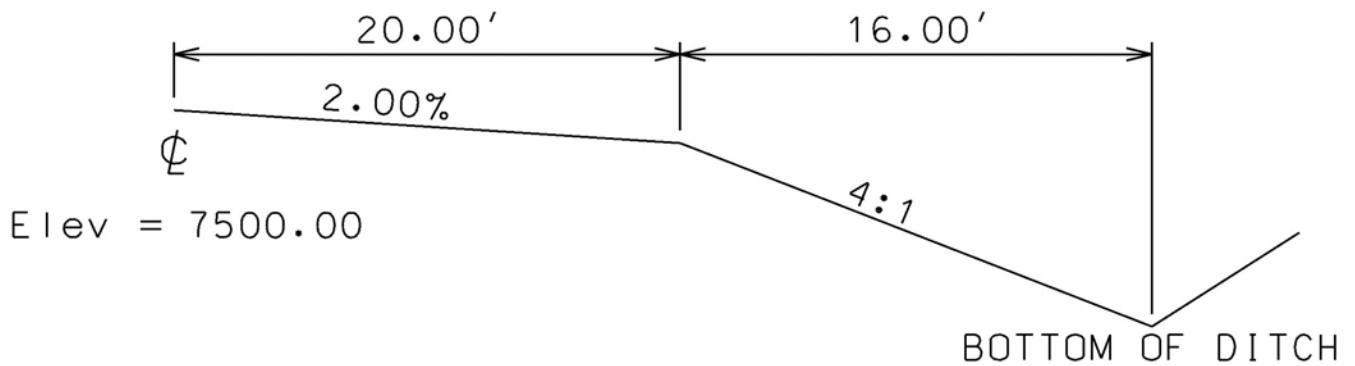
    a. 7504.00
    b. 7499.60
    c. 7496.00
    d. 7495.60
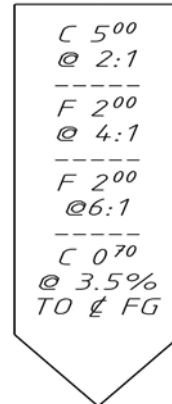
14. Given the following, determine the horizontal distance between A and B.
        Elev. A = 120.34
        Elev. B = 125.54
        Slope length of AB = 11.63
    a. 10.40
    b. 16.83
    c. 12.74
    d. 162.30

15. What is the elevation 35 feet from the slope stake shown below? The elevation of this stake is 5620.00. Cuts and fills are vertical distances.
    a. 5618.83
    b. 5601.50
    c. 5617.25
    d. 5618.65

```
 C 5⁰⁰
 @ 2:1
 -----
 F 2⁰⁰
 @ 4:1
 -----
 F 2⁰⁰
 @6:1
 -----
 C 0⁷⁰
 @ 3.5%
 TO ₵ FG
```

16. What is distance from the stake to edge of shoulder?
    a. 18 feet
    b. 30 feet
    c. 32 feet
    d. 50 feet

17. Given that the bottom of a ditch is at offset 24 feet right of centerline and at an elevation of 7428, which slope stake at the top of the cut will yield a 3:1 slope from the bottom of ditch to top of cut?
    a. Elev = 7432.50, Offset = 37.5 RT
    b. Elev = 7437.00, Offset = 33.0 RT
    c. Elev = 7432.50 Offset = 33.0 RT
    d. Elev = 7537.00, Offset = 37.5 RT

18. The following information is obtained from the plans and through survey in the field for a pipe where 150 feet of a run has been installed. What is your assessment of the installation?

    Beginning invert Elev = 6818.00
    150 LF of pipe has been installed
    Plan slope of pipe is 12.00%
    BM = 6809.35 FT
    B.S. = 4.30 FT
    F.S. to invert of last pipe installed = 11.32

    a. The pipe has been installed on grade at 10.5%.grade
    b. The pipe has been installed at a 4.66% grade
    c. The pipe has been installed at a 1.67% grade
    d. The pipe has been installed at a 3.50% grade

19. While installing a pipe, it is determined that the next 8 foot length needs to be deflected down to stay on the correct grade. The pipe is 36" RCP and it is allowed to have a maximum of 1.0 inch gap at the bell and spigot joint at the top of the pipe. What is the maximum amount in elevation that the pipe can be lowered when measured at the at the end of the pipe?
    a. 2 5/8 inches
    b. 2.67 Inches
    c. 0.25 feet
    d. 3/4 inches

20. The area of a cross section at station 4+50 is 10.31sq. in., and at station 5+00 is 14.18 sq. in. The horizontal scale of the cross section is 1" = 40' and the vertical scale is 1" = 10'. What is the volume of earthwork between these two stations, in cubic yards, using the average end area method?
    a. 45
    b. 18141
    c. 9070
    d. 907

1) a. 117.81 feet

2) a. Horizontal or level distance

3) d. All of the above

4) a. 7.7

5) b. Providing all surveying needed to locate and define the contract work

6) b. 166.67 feet

7) c. 36 degrees, 8 min, 42 sec.

8) b. Set up the instrument within 300 feet of all points to be surveyed

9) a. It is calculated using the trigonometry and the measured slope distance

10) a. Requires no equipment and should be completed with natural steps

11) c. 100.47

12) a. 89.17

13) b.7499.60

14) a. 10.40

15) a. 5618.83

16) b. 30 feet

17) a. Elev = 7432.50, Offset = 37.5 RT

18) a. The pipe has been installed on grade at 10.5% grade

19) b. 2.67 inches

20) c. 9070