

NSPS

SURVEY TECHNICIAN CERTIFICATION
PROGRAM

LEVEL I
SAMPLE EXAMINATION QUESTIONS
ANSWERS & GUIDE



NATIONAL SOCIETY OF PROFESSIONAL SURVEYORS

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This booklet has been prepared to provide an example of what an actual Certified Survey Technician (CST) Examination might be like. In addition to the sample exam, it includes the answers to the sample questions given. Examples of where to find resources to solve these sample questions are given as well to aid the “student”. Using this as your only study guide is not recommended.

This sample examination is 25% of an actual exam. The work element order is the same as in the full examination with approximately one quarter the number of questions.

These are not actual questions from past exams, but do reflect the complexity and makeup of actual exam questions.

Additional information about the CST program and exam availability can be obtained at:

- www.nsps.us.com
- (240) 439-4615 ext. 112
- NSPS CST Program
5119 Pegasus Court, Suite Q
Frederick, MD 21704

The “resources” mentioned are not particularly endorsed for any specific reason nor are they endorsed by the ACSM, NSPS, or other Survey related Association or Society. They represent a cross section of how, where, and what may be utilized as a resource to derive methods of study in preparation for the CST Exams.

The NSPS does have a bibliography of reference resources at the following website (See the page 17 of the PDF document).

<http://www.nsps.us.com/index.cfm?fuseaction=Page.viewPage&pageId=779&grandparentID=527&parentID=775&nodeID=2>

They also mention that at minimum an examinee should bring:

- 1). A Fundamental Surveying Text (with Unit Conversion Charts)
- 2). A First Aid & Safety Manual
- 3). A Surveying and Mapping Dictionary

WORK ELEMENTS

Test problems will be taken from the following work elements:

1) Surveying History (5)

Knowledge of the historical development of survey procedures and practices.

2) Types of Surveys (10)

Knowledge of the different types of surveying and the basic differences between them.

3) Field Equipment & Instruments (41)

Knowledge of the care, cleaning, and use of surveying tools and equipment, including field radios. Understand the names, purpose and parts, setup, transport and the need for calibration of various surveying field instruments. Some historical knowledge is required.

4) Electronic Instruments (8)

Knowledge of the handling, setup, and care of electronic instruments and their accessories.

5) Control Points: Horizontal & Vertical (6)

Knowledge of types of surveying control points and their differences.

6) Plan Reading (17)

Knowledge of the types of survey maps and the ability to obtain basic information from these maps.

7) Survey Computations (50)

Knowledge of mathematics and measurements relating to surveying (including linear, angular, elevations, and unit systems conversion).

8) Field Operations (21)

Knowledge of the field duties of a Survey Technician. Such duty areas may include line clearing, establishing points, taping, leveling, and compass reading.

WORK ELEMENTS (cont.)

9) Field Notes (5)

Knowledge of the basic types of surveying field notes.

10) Drafting (17)

Knowledge of basic drafting and CAD skills, tools, and procedures.

11) First Aid & Safety (20)

Basic knowledge of treatment practices for a variety of medical emergencies. Knowledge of traffic control and safety procedures for surveying and construction operations, including Occupational Safety and Health Administration (OSHA) standards.

CST LEVEL I SAMPLE TEST

Survey History

1. The United States Public Land Survey System was established under the direction and guidance of:
 1. Benjamin Franklin
 2. George Washington
 3. John Hancock
 4. Thomas Jefferson

Types of Surveys

2. Hydrographic surveys must be referenced to which of the following control:
 1. Horizontal only
 2. Horizontal and vertical
 3. Vertical only
 4. Tidal
3. Stadia surveys are most commonly used as a method for measuring _____.
 1. Meridians
 2. Bearings
 3. Topographic data
 4. Azimuths

Field Equipment & Instruments

4. When performing level loops, what is the recommended manner to move an automatic level from one set up to the next?
 1. Place the tripod and level on the tailgate of the truck
 2. Leave the level on the tripod and carry it horizontally over your shoulder
 3. Leave the level on the tripod and carry it upright in front of yourself
 4. Remove the level from the tripod and put it in its case
5. What is the length of each of the painted alternating bands of contrasting colors on a range pole?
 1. 0.50'
 2. 1.00'
 3. 1.25'
 4. 1.50'

6. Which of the following tools should you use when cutting brush?
1. Pliers
 2. Maul
 3. Wrench
 4. Machete
7. While the rodman, with a Philadelphia level rod, goes downhill from the Level instrument, the level operator readings are:
1. Getting smaller
 2. Getting harder to see
 3. Getting easier to see
 4. Getting larger
8. The needle of the surveyor's compass points to:
1. True north
 2. Geodetic north
 3. Geographic north
 4. Magnetic north
9. The alternating colors on a range pole are usually painted:
1. White and black
 2. White and pink
 3. White and green
 4. White and red
10. The proper method to use for cleaning a steel chain is to _____.
1. Wash with soap and water
 2. Remove foreign material and apply a light coat of oil
 3. Grind off foreign material and apply a light coat of oil
 4. Use a rust preventative and polish with a soft dry cloth
11. The cross-sectional shape of most range poles is what shape?
1. Square
 2. Triangle
 3. Rectangle
 4. Round
12. What would be the instrument most commonly used to run a benchmark circuit?
1. Abney hand level
 2. Total station
 3. Self-leveling level
 4. Dumpy level

13. The reason back-sights and fore-sights are “balanced” in leveling, is for :

1. Simplification of computations
2. Ease in finding turning points
3. Keeping the size of the numbers on the rod the same
4. Correcting for instrument mis-adjustment

Electronic Instruments

14. Most total station distance measurements are based upon:

1. Speed of light
2. Stadia measurements
3. Distance between upper and lower transit readings
4. Speed of sound

15. Which of the following procedures will increase the range of a total station measurement?

1. Inverting the prism
2. Measuring at noon
3. Using multiple prisms
4. Using new batteries

Control Points – Horizontal & Vertical

16. The star that is predominantly used for observations for latitudes in the United States:

1. Cassiopeia
2. Arcturus
3. Spica
4. Polaris

17. What is the primary federal agency responsible for horizontal and vertical control throughout the United States?

1. BLM
2. NGA
3. NGS
4. USGS

Plan Reading

18. The number 34 in the term “T.34N.” is usually associated with a:

1. Temporary point
2. Town
3. Township
4. Traverse point

19. If a point measures $7 \frac{1}{4}$ " from a triangulation point on a map whose scale is 1:62,500. How many miles apart are the two points on the ground?
1. 7.15
 2. 7.25
 3. 6.90
 4. 11.43
20. One method used to accurately determine the area of an irregular boundary on the hard copy of a drawing would be to use a:
1. Planimeter
 2. Scale and triangle
 3. Protractor
 4. Compass and cross section paper
21. Which one of the following scales is primarily used in the United States for scaling distances on a surveying drawing?
1. Engineer's scale
 2. Architect's scale
 3. Metric scale
 4. Vernier scale
22. A line connecting points of equal elevations on a map is called a/an:
1. Property line
 2. Critical areas line
 3. Line of equal elevation
 4. Contour line

Survey Computations

The following problems require basic math, geometry, trigonometry, comprehension of Survey drawings, maps, worksheets and how to interpret this data into something useful per each dilemma. Again, there isn't any one definitive book or media to rely on for a straight forward answer to these problems. It is through experience and familiarity of how they interact that there comes a wisdom of what is needed to be done. Studying a Math course geared toward Survey & Engineering is a solid beginning into the Computation World of Surveying.

23. What is the sum in degrees of the interior angles of a six-sided polygon?
1. 360
 2. 540
 3. 720
 4. 900

24. A new point at a lower elevation was set using a level directly from a benchmark. If the rod was clamped 0.20 feet too low from the correct setting for the point reading only, by how much would the point's elevation be in error?
1. Not in error
 2. 0.2' too high
 3. 0.4' too low
 4. 0.2' too low
25. The correct stationing of a point measured $7' 7\frac{3}{4}"$ ahead on line (forward) from station 150+45, would be:
1. 150+37.35
 2. 160+07.50
 3. 150+52.65
 4. 150+52.75
26. When measuring $6' 6\frac{1}{2}"$ back from station 50+00, what would be the station of the new point?
1. 49+93.40
 2. 49+93.46
 3. 50+06.60
 4. 50+06.54
27. If the elevation of a level instrument is 106.57', what is the elevation of the ground when the rod reading is 6.22'?
1. 100.35'
 2. 103.50'
 3. 106.57'
 4. 107.16'
28. A right triangle has sides of 37.00' and 49.33'. What is the length of the hypotenuse?
1. 32.63'
 2. 45.00'
 3. 49.33'
 4. 61.67'
29. What is the equivalent of 4.25 meters in feet?
1. 12.750
 2. 13.940
 3. 13.944
 4. 13.250

30. In highway work, grade is usually given in terms of:
1. Percent
 2. Degrees
 3. Elevation
 4. Slope
31. The error resulting from using a tape that is too short is known as a(n) _____ error.
1. Cumulative
 2. Random
 3. Erratic
 4. Compensating
32. The legal area of a parcel of land is measured:
1. Vertically
 2. Horizontally
 3. Along the ground surface
 4. Between the ellipsoid and geoid
33. A rectangular parcel of land is 44.806 meters x 171.603 meters. What is the area of the parcel in square feet?
1. 7,688.628
 2. 8,276.170
 3. 76,886.280
 4. 82,761..680
34. Which of the following statements best describes precision?
1. The finest measurement
 2. Degree of refinement of measurement
 3. Largest number of significant figures in a measure
 4. Care in reading the instrument

Field Operations

35. A 100 foot cloth or fiber tape is most likely used for measuring _____.
1. Traverse measurements
 2. Property measurements
 3. Slope stakes locations
 4. Center line

36. When using a Plumb Bob in a slight wind:
1. The point of the plumb bob should be set on the point to eliminate sway
 2. You should get someone to hold the plumb bob on the point
 3. You should bounce the plumb bob lightly on the point
 4. You should hold the plumb bob with your foot
37. Which of the following procedures would result in the largest error in a 100 foot standardized chain?
1. Chain is 2 feet off line
 2. Chaining on a 5% slope without correcting
 3. Chain supported throughout with too much tension
 4. Suspended chain supported at both ends with 10 lbs of tension.
38. Cross-section areas are used to calculate:
1. The cost of the dirt moved
 2. Right angle offsets from the centerline
 3. The excavation fill total
 4. Total excavation quantities
39. What is the purpose of maintaining equal backsights and foresights in a level circuit?
1. For easier calculations
 2. Minimize refraction errors
 3. For the convenience of the operator
 4. Minimize instrument error
40. Survey notes are usually recorded:
1. During lunch break
 2. At the time of the field work
 3. Back in the office at the end of the day
 4. Before the work is done

Drafting/CAD

41. Which of the following is NOT an element of a horizontal curve?
1. Long chord
 2. Length
 3. Radius
 4. Slope

42. You have plotted a road profile. The curve you are looking at is a _____ curve.
1. Horizontal
 2. Reverse
 3. Spiral
 4. Vertical
43. The manual tool used to draw a small circular curve is a :
1. Compass
 2. French Curve
 3. Proportional divider
 4. Protractor
44. The term "2H" refers to a lead:
1. Hardness
 2. Darkness
 3. Softness
 4. Strength
45. A rule for placing text in CAD is that all text should be placed so that it can be read from the _____ side.
1. Center
 2. Bottom
 3. Bottom and right
 4. Bottom and left

First Aid & Safety

The following problems require understanding First Aid, CPR, OSHA Regulations and comprehending the value of abiding and enforcing Safety by practicing good work habits. Red Cross pamphlets, books, and OSHA Regulations are available online or can be purchased for review and study. A course in First Aid and/or CPR is also an excellent way to learn the importance of safety and receive training at the same time. Again, these problems do not have a single definitive book to derive answers from. Experience, training (First Aid, CPR, etc...) and studying the guidelines of safe work habits are an accumulative effort.

46. Individual safety is the responsibility of:
1. Each individual
 2. The property owner
 3. The equipment supplier
 4. The owner of the company

47. Which of the following has responsibility for overall safety on a construction project?

1. The project owner
2. The design engineer
3. The safety inspectors
4. Everyone working on the project

48. All of the following are required on a typical roadway construction project except for:

1. Hard hats
2. Safety vest
3. Protective goggles
4. Work shoes

49. Which of the following is NOT a safety rule when using a screwdriver?

1. Keep the tips of screwdrivers properly ground and squared
2. Select a screwdriver to fit the size of the screw
3. Keep all parts of your body clear of the screwdriver tip in case it slips
4. Keep a large screwdriver around to use to as a pry tool or wrench


50. Why is it not recommended that survey party members wear soft-soled shoes?

1. Other survey party members may not like the color of tennis shoes
2. They're easily penetrated by sharp stubs, nails or glass
3. Snakes like tennis shoes
4. Tennis shoes get wet

LEVEL I

SAMPLE EXAMINATION ANSWERS

- 1.) **Ans. #4**
Thomas Jefferson-from the National Atlas website (Bureau of Land Management)
http://www.nationalatlas.gov/articles/boundaries/a_plss.html
- 2.) **Ans. #2**
Horizontal & Vertical-from page 245
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of Maine
- 3.) **Ans. #3**
Topographic Data-from page 237
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of Maine
- 4.) **Ans. #3**
Leave the level on the tripod and carry it upright in front of yourself-no reference-this is best-case scenario with level in front you can best protect it from being damaged, Experience and deductive reasoning.
- 5.) **Ans. #2**
1.00'-from page 213
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of Maine
- 6.) **Ans. #4**
Machete-no reference-simple deduction the other tools are not meant to cut brush
- 7.) **Ans. #4**
Getting larger-the reading of the number amount/value would be a larger number as the rodman descends downhill therefore needing more height of the rod to read, however this questions syntax is misleading-the answer should be the numeric reading or value is increasing-#4 could be mistaken as the numbers are just getting visually larger. Something to consider when choosing an answer...what is the best possible answer offered

- 8.) **Ans. #4**
Magnetic north-from page 53
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of
Maine
- 9.) **Ans. #4**
White and red-from page 213
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of
Maine
- 10.) **Ans. #2**
Remove foreign material and apply a light coat of oil-from page 20 Chapter 2 Subtitle
"Using Surveyors Chains"; "
"Landscape Surveying", Copyright 2004
Harry L. Field
Pearson Prentice Hall
Chapter 2 Equipment Page 20
- 11.) **Ans. #4**
Round-see photo below typical "Range Pole" from
http://www.chiefsupply.com/Survey/Range_Poles/CSTRANGE
- 
- 12.) **Ans. #3**
Self-leveling level- from page 144 (read through the various options of levels to see why
this vs. others)
"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of
Maine
- 13.) **Ans. #4**
Correcting for instrument mis-adjustment-from page 7-16 Chapter 7 Subtitle "Balance
Backsights and Foresights"
"Construction Surveying and Layout", Copyright 2003
Wesley G. Crawford
Creative Construction Publishing, Inc
Chapter 7 Subtitle "Balance Backsights and Foresights"

14.) **Ans. #1**

Speed of light-reasoning states that the EDM uses laser "light" to shoot a prism or object (prism mode & non-prism mode) and its return signal to the instrument (using laser light it can then use the "Speed of light" which is 299,792,458 meters per second to measure the distance to an object). Also see page 262 Definitions of Surveying & Assoc. Terms

"Definitions of Surveying & Associated Terms", Revised Copyright 2005
American Congress on Surveying and Mapping in collaboration with the University of Maine

15.) **Ans. #3**

Using multiple prisms-from <http://gigaenergy.toshiba.com/eng/positioning/pdf/gpt-7500.pdf> (study the specifications of prism modes showing the variances concerning the number of prisms being used and how they increase the range)

16.) **Ans. #4**

Polaris- from page 199 Definitions of Surveying & Assoc. Terms, also further study of the remaining stars show they were used by early Europeans & people of the Mediterranean

"Definitions of Surveying & Associated Terms", Revised Copyright 2005
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17.) **Ans. #3**

NGS (National Geodetic Survey)- from page 175

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18.) **Ans. #3**

Township- from the websites; these cover a good general understanding of the PLSS and its history

[http://en.wikipedia.org/wiki/Public_Land_Survey_System#Commonly used terms.5B3.5D](http://en.wikipedia.org/wiki/Public_Land_Survey_System#Commonly_used_terms.5B3.5D)

http://www.nationalatlas.gov/articles/boundaries/a_plss.html

- 19.) **Ans. #1**
7.15- map is 1:62500 every 1 foot represent 62500' so take $62500 / 12 = 5208.3333333$ ' per inch. Then take 5208.3333333×7.25 ($7\frac{1}{4}$ converted to decimal from fraction) = 37760.41667' then take $37760.41667' / 5280'$ (the amount of feet in a mile) = 7.151594066 or 7.15 miles

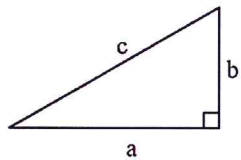
 no single media can explain this; a good understanding of unit measurement conversion and translating ratio, proportion and percent values are essential (math)
- 20.) **Ans. #1**
Planimeter- from page 195
 "Definitions of Surveying & Associated Terms", Revised Copyright 2005
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- 21.) **Ans. #1**
Engineer's scale-examine any survey map or drawing to see this type of scale; also the following website from XXFF gives good examples of what scale to use for what job:

http://www.gactaern.org/Unit%20Plans/Architectural%20Drawing%20and%20Design/Intro%20Engineering%20Draw%20and%20Design/IEDD_4_Types%20of%20scales.pdf
- 22.) **Ans. #4**
Contour line- from page 57
 "Definitions of Surveying & Associated Terms", Revised Copyright 2005
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- 23.) **Ans. #3**
720°-using the interior angle formula computation (N represents a number of interior angles) $(N-2) \times 180 = \text{answer}$; $(6-2) \times 180 = 720$ (Trigonometry, Triangles & Geometry)
- 24.) **Ans. #2**
0.2' too high-only the "new" point was affected and a low rod read translates into a higher elevation error.
- 25.) **Ans. #3**
150+52.65-using the following computation converting $7' 7\frac{3}{4}"$ to decimal of a foot ($7.75 \times 0.0833333 = 0.6458333$) then add to 7' (7.6458333) then add $7.6458333 + 15045.00$ (this is what 150+45 is when converted to non-stationing numeric value) = 15052.6458333 (round up to 15052.65) convert to stationing numeric value of 150+52.65 (Unit Conversion, Basic Math & Understanding Stationing).

26.) **Ans. #2**
49+93.46-using the same computation as in problem 25 to convert inches to decimal feet we get $6.5 \times 0.0833333 = 0.5416667$, then add to 6' ($6 + 0.5416667 = 6.5416667$), then subtract from 50+00 in its non-station numeric value ($5000 - 6.5416667 = 4993.4583333$) then convert to station numeric value of 49+93.46 again, rounding up. (Unit Conversion, Basic Math & Understanding Stationing).

27.) **Ans. #1**
100.35'- using the computation of a differential level read (HI = 106.57' – FS 6.22' ground elevation of 100.35') (Basic Math, Note Reduction for Levels & Operating a Level).

28.) **Ans. #4**
61.67'-using right triangle geometry formula $a^2 + b^2 = c^2$



side "c" being the hypotenuse and sides "b" being 37.00' and "a" being 49.33' we can solve for "c" ($37.00^2 + 49.33^2 = 1369 + 2433.4489 = 3802.4489$) then take the square root of $\sqrt{3802.4489} = 61.6640000$ (61.67 is the best possible answer of the 4 choices) (Right Triangle-Pythagorean Theorem)

29.) **Ans. #3**
13.944'- 1 meter in feet = 3.2808333' take this value and multiply it by 4.25 ($4.25 \times 3.2808333 = 13.9435415$) round up to 13.944' (Unit Conversion & Basic Math)

30.) **Ans. #1**
Percent-examine a few highway plats...primarily construction plans & drawings (Experience with Drawings, Maps & Worksheets)

31.) **Ans. #1**
Cumulative-this is also another way of saying accumulative- from page 99 "Definitions of Surveying & Associated Terms", Revised Copyright 2005 American Congress on Surveying and Mapping in collaboration with the University of Maine

32.) **Ans. #2**
Horizontally-all measurements taken to determine the area of a parcel are done horizontally (angular and distance)-these other answers make reference to 3rd dimensional measurements or vertical differences (Experience and familiarity with the Difference between Property-Boundary Surveys and Topography.)

- 33.) **Ans. #4**
82,761.680² feet-using the computation to convert meters to feet ($44.806 \times 3.2808333 = 147.0010168$ & $171.603 \times 3.2808333 = 563.0008368$) then multiply $147.0010168 \times 563.0008368 = 82,761.69547$ (best answer #4 82,761.680) (Unit Conversion).
- 34.) **Ans. #2**
Degree of refinement of measurement-from page 202
 "Definitions of Surveying & Associated Terms", Revised Copyright 2005
 American Congress on Surveying and Mapping in collaboration with the University of Maine
- 35.) **Ans. #3**
Slope stakes locations-grading (slope stakes) the horizontal position is important but its vertical measurement (elevation) is more of a concern than its horizontal measurement and a "soft" tape is good for this type of mass grading operation. Traverse and Property would require better measurements than what a "soft" tape could provide. Center line can be disregarded since it doesn't mention what the Center line is and what it's for (road, waterline, sewer, final grade, mass grading, stakeout of utility, etc...) (Experience with prioritizing what equipment is suitable for a specific job requirement).
- 36.) **Ans. #3**
You should bounce the plumb bob lightly on the point-getting someone else to hold the plumb bob or using your foot can be eliminated since they won't resolve "sway" due to the wind, although holding the point of the plumb bob on the point is ideal you can't always see the point on the ground much less the point of the plumb bob; the remaining answer is the best and from the use of a plumb bob it is generally practiced by surveyors as a method to reduce "sway" (Experience with Equipment)
- 37.) **Ans. #2**
Chaining on a 5% slope without correcting-chaining 2' offline is miniscule (99.979'), and chain supported with too much tension is again miniscule in error, 10 lbs tension is an ideal chaining technique, leaving the 5% slope error as the best answer ($100 \times .05 = 5.00$); then $100^2 - 5^2 = 9975^2$ or its square root of 99.874' (Chaining Corrections)

 "Survey Chaining Corrections" (Registration Number TXu 1-706-156), Copyright 2010
 James Girard Badinger Jr
 Multiple Chapter references to all of these variances in Tape & Conditions
- 38.) **Ans. #4**
Total excavation quantities- from page 68
 "Definitions of Surveying & Associated Terms", Revised Copyright 2005
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- 39.) **Ans. #4**
Minimize instrument error- from page 7-16 Chapter 7 Subtitle "Balance Backsights and Foresights"; "Construction Surveying and Layout", Copyright 2003
Creative Construction Publishing, Inc
Chapter 7 Subtitle "Balance Backsights and Foresights"
- 40.) **Ans. #2**
At the time of the field work- from page 3-18 Chapter 3 Subtitle "Basic Practices";
"Construction Surveying and Layout" by Wesley G. Crawford (Leave no room for
Interpretation-subtitle shows that any delay in recording data can result in an error)

"Construction Surveying and Layout", Copyright 2003
Wesley G. Crawford
Creative Construction Publishing, Inc
Chapter 3 Subtitle "Basic Practices"
- 41.) **Ans. #4**

Slope-slope refers to vertical measurement-from page 16-13 Chapter 16 Chart of
"Calculation of Horizontal Curve Parts"; "Construction Surveying and Layout" by Wesley
G. Crawford

"Construction Surveying and Layout"
Copyright 2003
Wesley G. Crawford
Creative Construction Publishing, Inc
Chapter 16 Subtitle "Calculation of Horizontal Curve Parts"
- 42.) **Ans. #4**
Vertical-although a Horizontal curve could be part of this answer a Vertical Curve is the
best choice since Road Profiles refer to vertical measurement and a Vertical Curve is a
parabolic curve change in grade or elevation of a road. Reverse and Spiral are horizontal
curves.
- 43.) **Ans. #1**
Compass- from page 11-4 Chapter 11 Subtitle "Equipment (Drafting)";
"Construction Surveying and Layout", Copyright 2003
Wesley G. Crawford
Creative Construction Publishing, Inc
Chapter 11 Subtitle "Equipment (Drafting)"

- 44.) **Ans. #1**
Hardness- from page 11-4 Chapter 11 Subtitle Equipment (Drafting);
"Construction Surveying and Layout", Copyright 2003
Wesley G. Crawford
Creative Construction Publishing, Inc
Chapter 11 Subtitle "Equipment (Drafting)"
- 45.) **Ans. #3**
Bottom and right-this places text below (bottom) an entity drawn and the text allows reading as most text is left to right (which is the way we read most general text, signs, books, etc...left to right) also see any AutoCAD or CAD Manual for text references.
- 46.) **Ans. #1**
Each individual-this is pretty much common logic...if an individual is not acting in a reasonable and prudent manner (responsible for their own safety) then others can only do so much to help protect that person. Individual safety begins with you...the individual
- 47.) **Ans. #4**
Everyone working on the project- from page 2 Chapter 1 Subtitle "Safety of Formwork";
"Formwork for Concrete Structures" by Robert L. Peurifoy & Garold D. Oberlender...also many books, manuals, pamphlets, and signs designed for the purpose of reminding/training people for proper work safety ethics often begin with the words to some effect "Safety is everyone's responsibility"

"Formwork for Concrete Structures"
- 48.) **Ans. #3**
Protective goggles-goggles would be needed if cutting line or using a tool that strikes or drives (hammer) objects...some references to examine American Society of Safety Engineers, National Institute for Occupational Safety, National Safety Council & OSHA
- 49.) **Ans. #4**
Keep a large screwdriver around to use as a pry tool-this is another common logic...a screwdriver is for driving or removing screws...not prying up objects (as a pry bar or crowbar, would be used) refer to question #6 about proper cutting tools (Right tool for the right job).
- 50.) **Ans. #2**
They're easily penetrated by sharp stubs, nails or glass-again common logic and work boots with steel toe or steel shank soles are required by any legitimate company providing surveying & engineering services (Proper work attire).