

# Drafting

## Study Guide

### Assessments:

2701 Drafting Technician

2702 Architectural Drafter

2703 Mechanical Drafter



## Overview

This study guide is designed to help students prepare for the Drafting assessments. It not only includes information about the assessments, but also the skills standards upon which the assessments are based and test taking strategies.

Each of the four sections in this guide provides useful information for students preparing for the Drafting assessments.

- CareerTech and Competency-Based Education: A Winning Combination
- Drafting assessments
  - ▶ Assessment Information
  - ▶ Standards and Test Content
  - ▶ Sample Questions
  - ▶ Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

The assessments measure a student's ability to apply knowledge of the skills necessary for success in the Drafting sector.

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# CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the workforce.

## Tools for Success

CareerTech education relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

**Curriculum materials and textbooks** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

**Certification assessments** test the student over material outlined in the skills standards and taught using the curriculum materials and textbooks. When used with classroom performance evaluations, certification assessments provide a means of measuring occupational readiness.

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

## Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Certification assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

# Drafting Assessment Information

## What are the Drafting assessments?

The Drafting Technician, Architectural Drafter, and Mechanical Drafter assessments are end-of-program assessments for students in drafting programs. The assessments provide an indication of student mastery of knowledge and concepts necessary for success in careers in these areas.

## How were the assessments developed?

The assessments were developed by CareerTech Testing Center. Items were created and reviewed by a committee of subject matter experts.

The committee assigned frequency and criticality ratings to each skill, which determines the significance of each task for test development:

**Frequency:** represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

1 = less than once a week      2 = at least once a week      3 = once or more a day

**Criticality:** denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

1 = slight                                  2 = moderate                                  3 = extreme

## What do the assessments cover?

Specifically, the tests include multiple-choice test items over the following areas:

### **Drafting Technician** (55 questions)

Use and Maintain Basic Drafting Equipment . . . . .	11%
Demonstrate Correct Lettering and Sketching Techniques . . . . .	6%
Solve Mathematical Problems Related to Drafting . . . . .	7%
Using a CAD System. . . . .	23%
Utilize Basic Geometric Construction . . . . .	13%
Utilize Hardcopy Reproduction Processes . . . . .	2%
Prepare Multiview Drawings . . . . .	7%
Prepare Section Views . . . . .	7%
Prepare Auxiliary Views . . . . .	2%
Apply Basic Annotation to a Drawing . . . . .	16%
Prepare Pictorial/Solid Model Drawings . . . . .	6%

**Architectural Drafter** (55 questions)

Appropriate Use of Reference Materials and Application Software . . . . .	6%
Preparing Land Feature Drawings . . . . .	9%
Prepare Detail Drawings . . . . .	18%
Prepare Building Design Drawings . . . . .	15%
Preparing Building; Electrical, Mechanical, and Building Systems Drawings . . . . .	13%
Solve Mathematical Problems Related to Architectural Drafting. . . . .	3%
Prepare Building Plans . . . . .	16%
Prepare Building Elevations and Sections. . . . .	20%

**Mechanical Drafter** (55 questions)

Demonstrate Appropriate Use of Reference Criteria and Application Software . . . . .	16%
Measurements, Annotations, Geometric Dimensioning and Tolerancing . . . . .	16%
Prepare Detail, Working, and Assembly Drawings . . . . .	18%
Demonstrate Appropriate Use of Manufacturing Processes and Materials . . . . .	11%
Prepare Power Transmission Drawings. . . . .	13%
Prepare Fasteners, Intersections, Developments, and Revolutions . . . . .	15%
Solve Mathematical Problems Related to Mechanical Drafting. . . . .	11%

## What are the benefits of using these assessments?

Students receive a certificate for each assessment that he/she passes. This certificate may be included in his/her portfolio and used to communicate the student's mastery of the subject matter to potential employers.

## When should the assessment be taken?

The CareerTech Testing Center recommends that students take the assessments as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

## Is the assessment timed?

No. However, most students finish the assessment within one hour.

## What resources can students use on these assessments?

Students are allowed to use calculators and scratch paper on CTTC assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps on cell phones and other devices may not be used on these assessments.

Students taking the Architectural Drafter assessment may access the following during testing:


- Architectural Graphics Standards

Students taking the Mechanical Drafter assessment may access the following during testing:

- Machinist's Ready Reference

## What accommodations can be made for students with Individualized Education Plans (IEPs)?

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- **Extended time** — These assessments are not timed; therefore, students may take as much time as needed to finish. The assessment must be completed in one testing session.
- **Readers** — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- **Enlarged text** — Students needing this accommodation can activate this feature by clicking the  icon in the upper right corner of the screen.

## What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor **cannot** be an instructor or anyone who was involved with the student during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Students may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that shows the student's score on the assessment and how the student performed in each standard area.

## Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who can retest must wait at least three days between test attempts.

## Standards and Test Content 270I Drafting Technician

### Duty A: Use and Maintain Basic Drafting Equipment (6 questions)

CODE	TASK	F	C
A.01	Identify and use drafting references, handbooks, vendor's product catalog, and related appropriate industrial standards where required.	3	3
A.02	Select drafting final product. • Media • Reproduction requirements	3	3
A.03	Draw the alphabet of line types.	3	3
A.04	Understand the concept of line weights.	3	3
A.05	Use and maintain drawing equipment (manual and electronic).	3	3
A.06	Use metric scale.	3	3
A.07	Use architect's scale.	3	3
A.08	Use civil engineer's scale.	3	3
A.09	Use mechanical engineer's scale.	3	3

### Duty B: Demonstrate Correct Lettering/Sketching Techniques (3 questions)

CODE	TASK	F	C
B.01	Identify and use appropriate industrial standards.	3	3
B.02	Add text to a drawing.	3	3
B.03	Perform freehand lettering.	3	3
B.04	Use sketching techniques.	3	3

### Duty C: Solve Mathematical Problems Related to Drafting (4 questions)

CODE	TASK	F	C
C.01	Use conversion tables and formulas from reference books.	2	3
C.02	Utilize appropriate reference handbooks. • Calculate area of objects • Calculate lengths of objects • Calculate volumes • Calculate perimeter of objects • Calculate weights of objects	2	3
C.03	Solve basic mathematical problems using geometry.	3	3
C.04	Solve basic mathematical problems using algebra.	2	3
C.05	Solve basic mathematical problems using trigonometry.	1	2

**Duty D: Using a CAD System (13 questions)**

CODE	TASK	F	C
D.01	Use operating systems. • Maintain file system • Internet/Intranet • Utilities • Storage devices	3	3
D.02	Identify hardware of a CAD workstation.	3	3
D.03	Execute application software for CAD.	3	3
D.04	Configure CAD workstation.	1	2
D.05	Utilize various coordinate systems.	3	3
D.06	Manipulate CAD drawings. • Create • Retrieve • Modify	3	3
D.07	Customize application software.	1	1
D.08	Convert an existing hard copy drawing to an electronic format.	1	1
D.09	Utilize drawing management standards. • Drawing naming conventions • Line weights • Predefined drawing setup • CAD settings (system variable) • Object management • Fonts • Line types • Layer naming conventions	3	3
D.10	Develop symbols, text based information, and libraries.	3	3
D.11	Develop basic 3D drawings.	2	2
D.12	Set up plot parameters.	3	3
D.13	Integrate other software with CAD applications.	2	2
D.14	Import/export drawings from/to various graphic formats.	1	2
D.15	Print/plot drawings.	3	3

**Duty E: Utilize Basic Geometric Construction (7 questions)**

CODE	TASK	F	C
E.01	Bisect lines, arcs, and angles.	3	3
E.02	Prepare angles.	3	3
E.03	Prepare perpendicular and parallel lines.	3	3
E.04	Prepare geometric shapes.	3	3
E.05	Prepare drawings of tangent lines and arcs.	3	3
E.06	Prepare drawings of ellipses.	3	3
E.07	Prepare involutes.	1	2

**Duty F: Utilize Hardcopy Reproduction Processes (1 question)**

CODE	TASK	F	C
F.01	Operate copy machines.	1	1
F.02	Operate printers, plotters, and scanners.	3	3



**Duty G: Prepare Multiview Drawings (4 questions)**

CODE	TASK	F	C
G.01	Select proper views.	3	3
G.02	Determine and utilize line precedence.	3	3
G.03	Prepare freehand orthographic sketches.	3	3
G.04	Prepare orthographic projection drawings.	3	3

**Duty H: Prepare Section Views (4 questions)**

CODE	TASK	F	C
H.01	Identify and select proper section views.	3	3
H.02	Draw sections to current ANSI standards.	3	3

**Duty I: Prepare Auxiliary Views (1 question)**

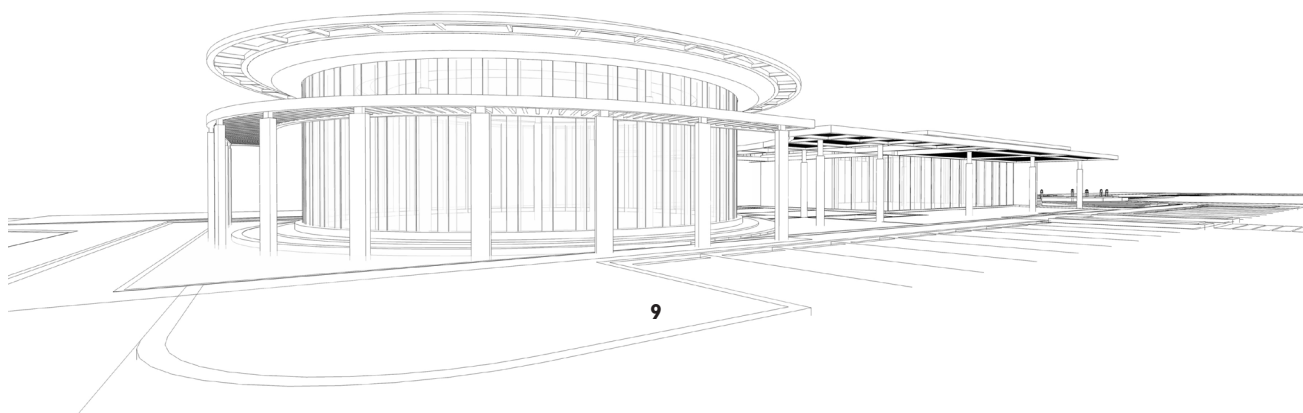
CODE	TASK	F	C
I.01	Select proper auxiliary plane. • Inclined and oblique surfaces	1	1
I.02	Draw auxiliary views.	1	2

**Duty J: Apply Basic Annotation to a Drawing (9 questions)**

CODE	TASK	F	C
J.01	Draw dimension and extension lines.	3	3
J.02	Apply adequate drawing notations.	3	3
J.03	Apply dimensions and tolerances to appropriate drawings.	3	3
J.04	Use appropriate abbreviations.	3	3
J.05	Apply finish marks.	3	3

**Duty K: Prepare Pictorial/Solid Model Drawings (3 questions)**

CODE	TASK	F	C
K.01	Prepare freehand pictorial sketches.	1	3
K.02	Prepare axonometric drawings. • Isometric • Trimetric • Dimetric	1	2
K.03	Prepare oblique drawings.	1	2



## Standards and Test Content 2702 Architectural Drafter

### Duty L: Apply Principles of Commercial and Residential Architectural Drafting (3 questions)

CODE	TASK	F	C
L.01	Use appropriate reference materials.	3	3
L.02	Use appropriate application software for architectural drafting.	3	3

### Duty M: Preparing Land Feature Drawings (5 questions)

CODE	TASK	F	C
M.01	Read plat maps.	1	1
M.02	Interpret and prepare site plans.	3	3

### Duty N: Prepare Detail Drawings (10 questions)

CODE	TASK	F	C
N.01	Prepare drawings of window and door details and sections.	3	3
N.02	Prepare drawings of cabinet details.	3	3
N.03	Prepare drawings of commercial or residential stair details. • Steel • Concrete • Wood	3	3
N.04	Prepare drawings of roof details.	3	3
N.05	Prepare window, door, and finish schedules.	3	3

### Duty O: Preparing Building Design Drawings (8 questions)

CODE	TASK	F	C
O.01	Preparing commercial or residential preliminary presentation sketches, floor plans, site layouts, elevations, and sections.	3	3
O.02	Apply appropriate dimensions.	3	3
O.03	Select and use appropriate architectural symbols and abbreviations.	3	3
O.04	Apply appropriate annotations.	3	3
O.05	Research appropriate codes. • IBC • ADA • IRC	3	3
O.06	Prepare and develop 3D drawings and renderings.	1	3

**Duty P: Preparing Building: Electrical, Mechanical, and Building Systems (7 questions)**

CODE	TASK	F	C
P.01	Read shaft drawings. • Elevator • Utility • Ventilator	1	1
P.02	Interpret and prepare commercial or residential electrical detail drawings.	3	3
P.03	Interpret and prepare heating, ventilation, and air conditioning system drawings.	1	1
P.04	Interpret and prepare plumbing system plans.	1	1
P.05	Prepare reflected ceiling plan.	1	1

**Duty Q: Solve Mathematical Problems Related to Architectural Drafting (2 questions)**

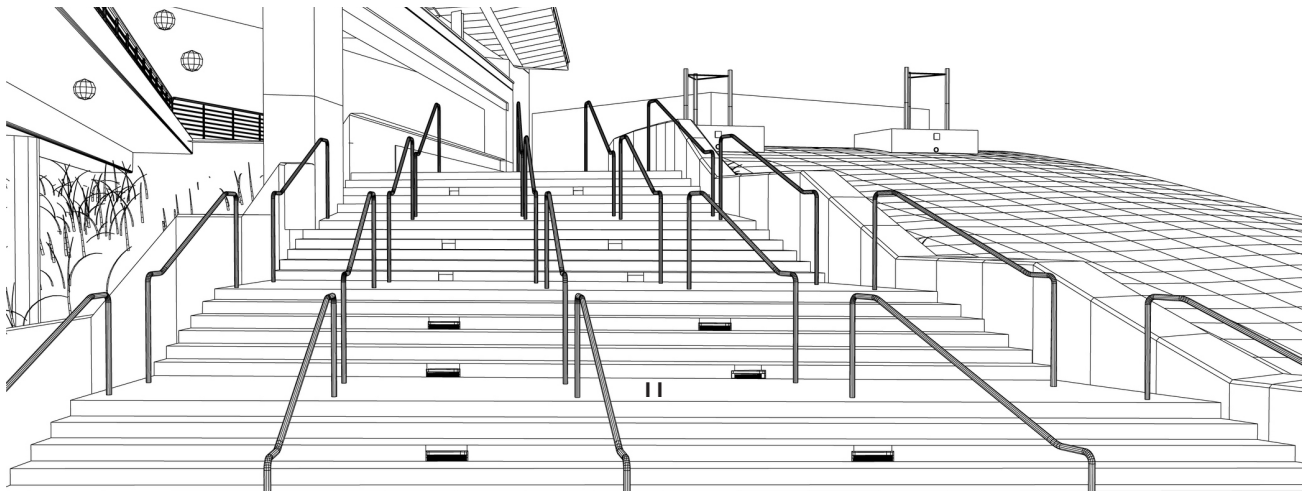
CODE	TASK	F	C
Q.01	Solve problems in trigonometry.	1	3
Q.02	Solve problems in calculus.	1	2

**Duty R: Prepare Building Plans (9 questions)**

CODE	TASK	F	C
R.01	Prepare floor plans.	3	3
R.02	Prepare foundation/basement plans.	3	3
R.03	Prepare roof framing plans.	3	3

**Duty S: Prepare Building Elevations and Sections (11 questions)**

CODE	TASK	F	C
S.01	Prepare architectural elevation drawings.	3	3
S.02	Prepare cross sections.	3	3
S.03	Prepare drawings of commercial or residential wall and roof sections.	3	3
S.04	Prepare commercial or residential interior elevation drawings.	3	3
S.05	Prepare fireplace/chimney detail drawings.	3	3
S.06	Select and use appropriate architectural sectional symbols.	3	3



## Standards and Test Content 2703 Mechanical Drafter

### **Duty T: Demonstrate Appropriate Use of Reference Criteria and Application Software (9 questions)**

CODE	TASK	F	C
T.01	Prepare bill of materials for drawings.	3	3
T.02	Denote manufacturing treatments of materials in drawings.	3	3
T.03	Denote shop processes to be used.	3	3
T.04	Use appropriate application software for mechanical drafting.	3	3
T.05	Research and apply appropriate standards. • ISO • ANSI	3	3

### **Duty U: Measurements, Annotations, Geometric Dimensioning, and Tolerancing (9 questions)**

CODE	TASK	F	C
U.01	Use precision measuring equipment.	3	3
U.02	Prepare revision drawings, notes, and abbreviations.	3	3
U.03	Use tables to determine tolerances and fits.	3	3
U.04	Apply geometric dimensioning and tolerancing.	2	3
U.05	Apply finish marks.	3	3

### **Duty V: Prepare Detail, Working, and Assembly Drawings (10 questions)**

CODE	TASK	F	C
V.01	Prepare working, assembly, detail, and development drawings.	3	3
V.02	Prepare weldment drawings. • Symbols • Annotations	3	3
V.03	Prepare drawings of bearings and seals. • Lubricant notation	1	3
V.04	Prepare geometry for exporting/translation for manufacturing process.	3	3
V.05	Prepare and develop 3D drawings.	3	3

### **Duty W: Demonstrate Appropriate Use of Manufacturing Processes and Materials (6 questions)**

CODE	TASK	F	C
W.01	Prepare casting drawings.	1	3
W.02	Prepare forging drawings.	1	3
W.03	Prepare jig and fixture drawings.	1	3
W.04	Prepare tool and die.	1	3
W.05	Identify appropriate materials designation.	2	3

**Duty X: Prepare Power Transmission Drawings (7 questions)**

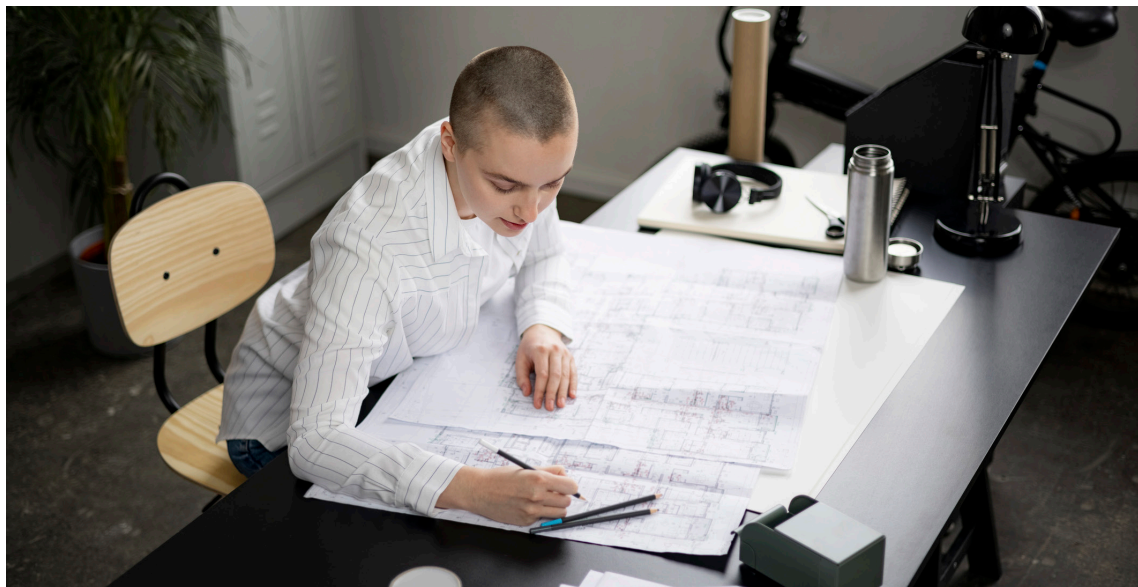
CODE	TASK	F	C
X.01	Prepare spur, bevel, rack and pinion, couplings, and worm gear drawings.	1	3
X.02	Prepare cam drawings, linkages, and actuator drawings.	1	3
X.03	Prepare spring drawings.	1	3
X.04	Prepare mechanical power transmission drawings. <ul style="list-style-type: none"><li>• Belts, chains, and gears</li></ul>	2	3

**Duty Y: Fasteners, Intersections, Developments, and Revolutions (8 questions)**

CODE	TASK	F	C
Y.01	Prepare drawings of fasteners. <ul style="list-style-type: none"><li>• Thread types</li><li>• Rivets</li><li>• Washers</li><li>• Bolt definitions and configurations</li></ul>	3	3
Y.02	Prepare intersections.	1	3
Y.03	Prepare developments.	1	3
Y.04	Prepare revolution drawings.	1	3
Y.05	Prepare sheet metal assembly drawings.	1	3

**Duty Z: Solve Mathematical Problems Related to Mechanical Drafting (6 questions)**

CODE	TASK	F	C
Z.01	Calculate bend allowances. <ul style="list-style-type: none"><li>• Depending on area of specialization</li></ul>	1	3
Z.02	Solve problems in trigonometry.	3	3
Z.03	Solve problems in calculus.	1	2



## Sample Questions

1. Find the hypotenuse of a right triangle whose sides are 6 and 8.
  - a. 5.29
  - b. 10
  - c. 28
  - d. 100
  
2. What method locates points measured from a previous point at a given distance and angle?
  - a. absolute rectangular
  - b. Cartesian
  - c. polar
  - d. rectangular
  
3. In residential construction, what is the standard rough-in opening height of a finished door that is 6'8"?
  - a. 6'8"
  - b. 6'9"
  - c. 6'10"
  - d. 7'2"
  
4. The extension of a wall above the roof line used to hide mechanical equipment is called a:
  - a. parapet.
  - b. plancher.
  - c. purlin.
  - d. rake.
  
5. A dimension line on a drawing is:
  - a. thick/dark.
  - b. thick/light.
  - c. thin/dark.
  - d. thin/light.
  
6. In a technical drawing, leaders are terminated with:
  - a. arrowheads.
  - b. circles.
  - c. dots.
  - d. tick marks.

7. Which drawing shows the location and orientation of structures?
- a. elevation.
  - b. floor plan.
  - c. foundation.
  - d. site plan.
8. What part of a building carries the weight of the structure and distributes the building's weight directly to the earth?
- a. concrete lintel
  - b. footing
  - c. grade beam
  - d. pile cap
9. What small beam, laid at a right angle to the truss, is used to support the roof decking when the trusses are widely spaced?
- a. lintel
  - b. parapet
  - c. purlin
  - d. soffit
10. Finish marks are used when the surface in question appears as a/an:
- a. auxiliary view.
  - b. edge view.
  - c. phantom line.
  - d. sectioned view.

## Sample Questions — Key

1. Find the hypotenuse of a right triangle whose sides are 6 and 8.
  - a. 5.29 Wrong, but plausible
  - b. 10 Correct
  - c. 28 Wrong, but plausible
  - d. 100 Wrong, but plausible
  
2. What method locates points measured from a previous point at a given distance and angle?
  - a. absolute rectangular Wrong, but plausible
  - b. Cartesian Wrong, but plausible
  - c. polar Correct
  - d. rectangular Wrong, but plausible
  
3. In residential construction, what is the standard rough-in opening height of a finished door that is 6'8" ?
  - a. 6'8" Wrong, but plausible
  - b. 6'9" Wrong, but plausible
  - c. 6'10" Correct
  - d. 7'2" Wrong, but plausible
  
4. The extension of a wall above the roof line used to hide mechanical equipment is called a:
  - a. parapet. Correct
  - b. plancher. Wrong, but plausible
  - c. purlin. Wrong, but plausible
  - d. rake. Wrong, but plausible
  
5. A dimension line on a drawing is:
  - a. thick/dark. Wrong, but plausible
  - b. thick/light. Wrong, but plausible
  - c. thin/dark. Correct
  - d. thin/light. Wrong, but plausible
  
6. In a technical drawing, leaders are terminated with:
  - a. arrowheads. Correct
  - b. circles. Wrong, but plausible
  - c. dots. Wrong, but plausible
  - d. tick marks. Wrong, but plausible



7. Which drawing shows the location and orientation of structures?

- a. elevation. Wrong, but plausible
- b. floor plan. Wrong, but plausible
- c. foundation. Wrong, but plausible
- d. site plan. Correct

8. What part of a building carries the weight of the structure and distributes the building's weight directly to the earth?

- a. concrete lintel Wrong, but plausible
- b. footing Correct
- c. grade beam Wrong, but plausible
- d. pile cap Wrong, but plausible

9. What small beam, laid at a right angle to the truss, is used to support the roof decking when the trusses are widely spaced?

- a. lintel Wrong, but plausible
- b. parapet Wrong, but plausible
- c. purlin Correct
- d. soffit Wrong, but plausible

10. Finish marks are used when the surface in question appears as a/an:

- a. auxiliary view. Wrong, but plausible
- b. edge view. Correct
- c. phantom line. Wrong, but plausible
- d. sectioned view. Wrong, but plausible

## Symbols and Acronyms

When abbreviations, symbols or acronyms are more commonly used in written and verbal communications within the drafting industry than the words they represent, they will also be used on the written examination required for competency. The following is a list of abbreviations, symbols and acronyms used on the drafting examinations.

#	Number
'	Feet
"	Inches
°	Degrees
2D	Two-dimensional
3D	Three-dimensional
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CAD	Computer-aided design
CAM	Computer-aided manufacturing
CNC	Computer numerical control
CPU	Central processing unit
ECO	Engineering Change Order
GFI	Ground Fault Indicator
LAN	Local area network
mm	Millimeter
NTS	Not to scale
UNC	Unified National Coarse

# Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

## General Testing Advice

1. Get a good night's rest the night before the test – eight hours of sleep is recommended.
2. Avoid junk food and “eat right” several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

## Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.



## NOTES

[illegible]