

LAYERED CURRICULUM™ FOR THE CONSTRUCTION TRADES:
A MATHEMATICS CURRICULUM
TO TEACH TRADE STUDENTS
BASIC MATH SKILLS TO BE SUCCESSFUL APPRENTICES

by

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CHAPTER I INTRODUCTION

Background

According to the U.S. Department of Labor in the 21st Century, most skilled craft jobs require proficiency in reading and mathematics. If those students who enter construction from an area technical or vocational school have had the mathematical training required of a skilled craft job, they may progress at a somewhat faster pace. Therefore, educators need to develop and implement a mathematics curriculum to teach the construction trades program students those skills and competencies needed to transition students from school to work successfully. Employers will benefit by receiving more qualified high school graduates and students will advance at a much quicker pace in the workforce.

DuPage Area Occupational Education System (DAOES), an Illinois Career and Technical Education (CTE) system has two major functions:

- planning for the delivery of CTE for a geographical area in Chicago's western suburbs,
- operating the Technology Center of DuPage (TCD), a Career and Technical Education center for 11th and 12th graders.

Located in Addison, Illinois, about 20 miles west of Chicago, DAOES provides services to schools and accepts enrollment from 14 high achieving school districts in the DuPage County area. DAOES serves students in the same geographical area as the College of DuPage. The System provides Career and Technical Education support to over 50,000 9-12 graders and more than 4,000 certified high school staff.

Member districts include: Hinsdale Township High School District 86, Glenbard Township High School District 87, DuPage High School District 88, Community High School District 94, Community High School District 99, Fenton Community High School District 100, Lake Park Community High School District 108, Wheaton Warrenville CUSD District 200, Westmont CUSD 201, Lisle CUSD 202, Naperville CUSD 203, Lyons Township H.S. District 204, Indian Prairie School District 204, and Elmhurst CUSD 205. (DuPage Area Occupational Education System, 2006).

The Technology Center of DuPage serves these 14 high school districts in DuPage, Illinois, and enrolls approximately 1300 junior and senior students each year. TCD offers an extensive construction trades program. Students attend the construction trades program for one or two years, depending on their career choice. A TCD credentialing process is used to award students with a certificate upon successful completion of the construction trades program in combination with minimum scores achieved on PSAE scores taken during the student's junior year in high school.

The curriculum in the construction trades program has been developed with input from local industry through advisory committees and the required curriculum created by the National Center for Construction Education and Research (NCCER). "The NCCER is a not-for-profit education foundation created to help address the critical workforce shortage facing the construction industry and to develop industry driven standardized craft training programs with portable credentials." (NCCER, 2006).

At the Fall 2006 TCD construction trades advisory committee meeting, members suggested a review of the basic mathematical skills and competencies required to enter the construction trades occupation. Their concern suggested the need to determine which

mathematical skills and competencies are necessary in order for students to make the successful transition from school to work.

Identifying those mathematical skills and competencies will help educators gain a greater understanding of the math skills and competencies workers need. It will help students and workers understand what they need to know to succeed in their career. Industry will benefit by increasing quality and productivity.

Purpose and Statement of the Problem

The purpose of the project is to determine the needed mathematical skills and competencies for successful transition of construction students from school to construction trades industry. More specifically, the research project is designed to determine what type of math curriculum is needed to be developed in order for students to attain the math skills and competencies, which are required of a Level 1 or Level 2 construction trades student entering the workforce.

The information could be used by educators and corporate trainers to determine student readiness for an entry-level employee to be productive in the construction trades industry.

Significance of the Problem

The purpose of this research project is to identify, prioritize and implement a math curriculum that reflects what employers expect from a Level 1 or Level 2 graduate of the TCD construction trades program as he or she enters the workforce.

The SCANS report (SCANS, 1991) identifies mathematics and computational skills as being one of the essential skills required from a graduate of a high school

vocational training program. Although the commission completed its work in 1992, its findings and recommendations continue to be a valuable source of information for individuals and organizations involved in education and workforce development.

Currently, no formal long-range math program exists for the TCD students in the construction trades program. The only formal construction math unit students are taught consists of a one week Introduction to Construction Math module. Approximately 30% of the students who enter the construction trades program come in with an individual educational program (IEP) identifying their math skill between the fourth and eighth grade levels. Therefore, a formalized math curriculum must be developed in an effort to prepare students in the construction trades program for industry.

Definition of Terms

DAOES: DuPage Area Occupational Educational System—An Illinois Career and Technical Education system which plans for the delivery of Career and Technical Educational in DuPage County and operates the Technology Center of DuPage for 11th and 12th graders.

TCD: Technology Center of DuPage—A facility governed by the 14 high school districts in DuPage County, Illinois, to provide capstone vocational training.

Construction Trades: The Level 1 and Level 2 residential carpentry training.

Math Skills and Competencies: Identifies an individual's ability to apply and understand the basic and computational math skills used in the carpentry industry.

IEP: Individual Educational Program—Identifies any learning disabilities that a student may have and recommends the necessary accommodation needed to aide in the student's learning process.

SCANS: Secretary's Commission on Achieving Necessary Skills—A report issued to parents, employers, and educators from the representatives of schools, businesses, unions, and government. They reported on the changes occurring in the workplace and the implications these changes will have for learning.

CTE: Career and Technical Education—Provides Training as a capstone technical education.

*LAYERED CURRICULUM*TM: “a teaching model that divides the learning process into three layers based on the complexity of the student's thought process.”

(Nunley, 2006, p. 28).

CHAPTER II

REVIEW OF LITERATURE

Although the premise of this project is to develop and implement a math curriculum for the TCD students in the construction trades program, the literature and development of this curriculum will be presented in four sections. The four parts will include: (a) learning abilities and differences of students, (b) teaching strategies to help different types of learners, (c) how the adolescent brain affects learning, and (d) curriculum development—careers to education.

Learning Styles

Successful learning does not just occur. One must plan and organize in order to maximize the learning of all students within the school year schedule. Every aspect of what is involved in classroom learning must be considered in the planning process. The first aspects that must be considered are the different learning styles and/or disabilities that students bring with them into the classroom. Some students' learning styles and/or disabilities may be identified when they are assigned to a class but the vast majority of times no identifying factors come with the students. Therefore, teachers are left with having to, according to Nolen (2003), struggle with finding ways to reach individual learning styles and needs.

Teachers must first understand the multiple intelligences that come to the classroom. According to Howard Gardner's theory, there are eight types of intelligences (Gardner, 1983). Each of these intelligences possesses certain characteristics that must be addressed by teachers in their daily lesson plans for use in the classroom.

Nolen (2003) lists *Gardner's Theory of Multiple Intelligences* as linguistic or verbal, musical, mathematical-logical, spatial, bodily kinesthetic, interpersonal, intrapersonal and naturalists. Teachers knowing these intelligences should accommodate these learning styles in their presentations. When lessons are centered on the different intelligences, teachers are able to address the learning needs of all students. It then involves the entire class of students.

Shortly after Gardner introduced the concept of multiple intelligences, Anthony Gregorc introduced teachers to the different Mind Styles. Gregorc's Four Mind Styles (Nunley, 2004) include concrete sequential, concrete random, abstract sequential, and abstract random. He was able to show how difficult it is for an abstract student to function in a classroom with a teacher who functions in concrete concepts. Alternatively, how difficult it is for a concrete student to function in a classroom where the teacher is an abstract thinker.

In addition, there are those students that come to the classroom with visible or invisible disabilities, including orthopedic, health-related, hearing, sight, learning and speech disabilities (Henderson, 1995). Individuals with mental and emotional disabilities differ in their range of severity. Learning disabilities (LD) are additional factors that present a challenge to teachers. Students with LD have a difficult time in receiving, processing, storing and/or retrieving information (Ross-Gordon, 2001).

Because so many individuals come with a multitude of disabilities, their needs become varied and complex. Other factors that contribute to the complexity of learning include "age, gender, ethnicity, language, culture, socioeconomic factors, geography, education, learning styles, and experience" (Gadbow, 2001, p. 19).

“Since the 1970’s the number of special education students have increased by 400 percent” (Nunley, 2004, p. 9). The numbers have increased so significantly that today one out of eight classroom students is considered a special education student. This increase is due to three basic principles. First, the instruments used today to identify students disabilities “have become more sophisticated” (Nunley, 2004, p. 9). Therefore, disabilities can be more readily identified and much sooner. Second, parents have become more informed and understand their rights and the services that their child is entitled to in the classroom. Third, we as a country have become more compassionate and understanding to the needs of the disabled in our country.

We need to look at the identification of disabilities as an ongoing event. More and more students are being identified as disabled. As a result, we are finding ourselves faced with an increasing amount of diversity in the classroom and fewer regular students than in the past. As a result, today’s classroom has become a diverse mix of inclusion of all special education students, unidentified special education students who opt out because of the stigma, English as a second language, learning style differences, multiple intelligences, mind styles and cultural diversity. The solution to this diverse grouping of students is to “modify the entire curriculum rather than make individual accommodations” (Nunley, 2004, p. 12).

Teachers or educators need to develop strategies that include the potential for all to learn. Instructors should not assume they know what all learners need. The only way to know what each learner needs in order to learn is to ask. Let the learner become the teacher (Vella, 1994).

Be creative in classroom strategies. Presenting and demonstrating material in one manner to a learner may offer other learners new strategies that may help them. In all

types of groups, learners encourage and offer assistance in learning not only for themselves but also for others in the group.

Regardless of what teaching strategies are decided upon, keeping in mind one must be flexible when dealing with learners, set the priorities and carry out the plans. “Once you know where you are going, you will need to decide how to get there” (Kuhn, 1998, p. 46). Students tend to remember poor training and not the content, but are excited by and retain the content of quality training (Kuhn, 1998).

The Adolescent Brain and Learning

The amount of brain research that has occurred in the last decade has afforded us a phenomenal amount of information on how the brain develops and functions. With this present information, education needs to re-think the way in which teachers deliver instruction. In addition, it proposes to make teaching and parenting easier with this understanding.

There are two critical parts of the brain that are central to learning, cortex and hypothalamus (Nunley, 2004). The part of the brain that most think of in the brain is the cortex. The cortex wraps and encloses those parts of the brain that are considered the more primitive parts one being the hypothalamus. In this cortex region, there in lies all of our learning that takes place in the brain. Everything one learns is stored in this area of. This is the part of the brain that classroom teachers need to reach for learning to take place. Unfortunately, since the brain works from the bottom-up, in order for learning to take place one must go through the primitive parts of the brain, hypothalamus, to reach the cortex.

The primitive parts of the brain, which includes the hypothalamus, are the areas that develop first. They fire up first or react first to any given situation. These primitive areas of the brain account for our basic survival. Once the need for basic survival has been met, one can involve the cortex of the brain. The hypothalamus, which is underneath the cortex or in the primitive part of the brain, controls many of our survival needs. These needs include control, fight or flight, hunger, thirst, sex drive, body temperature, water balance, and the endocrine system of hormones. It is the most primitive part of the brain that controls behavior (Nunley, 2004). When the hypothalamus is engaged or in a survival mode the reasoning, logical thinking, and decision making part of the cortex is totally ignored.

It has been concluded that an adolescent brain works very differently from the adult brain. The most active part of an adolescent's brain is the hypothalamus and occurs during adolescence. There are two reasons that support this finding. Those characteristics that are present in an adolescent that tend to increase the hypothalamus activity include hormones during puberty. Also, "adolescents are most influenced by their own peers" (Nunley, 2003, p. 48) or they tend to imitate behavior qualities present in individuals that are in close proximity to them.

The pre-frontal cortex does not fully mature for 21 years. Therefore, the voice of an adolescent says "eat-kill-sex" (Nunley, 2003) It is a constant cry that the adolescent hears in his mind. Just because an adolescent has an adult body does not mean that the brain it houses is an adult brain. Because of this, it can be seen how difficult it is to teach a group of adolescents with their hypothalamus engaged. If their home life reflects this "fight or flight" mode, their behavior will constantly be in survival mode where ever they are.

The question remains, what is a teacher to do with all these students in a classroom? Since adolescents feel they have very little control in their lives and their survival is threatened, the one element that will bring harmony to them is control. Because control satisfies the need of the hypothalamus it allows the other parts of the brain to become engaged which is mainly the cortex. Therefore, satisfying the survival needs of an adolescent should be of primary concern for a teacher. If the primitive parts of the brain are content, the cortex will become engaged for learning.

The first order of business in the classroom is to develop an atmosphere of trust, safety, and a perception of control (Nunley, 2004). With control, students will feel their survival is not threatened and become engaged to learn and grow. Allowing students to be in control is providing them with choices. When they are in control they have the ability to make a choice and therefore have to take ownership in the activities and behaviors they exhibit in the classroom. Teachers become the facilitator of learning and it no longer is the teacher-versus-student classroom battle.

The results from all this brain research has been the development of the Layered Curriculum™ (Nunley, 2004). The design lends itself to a student-centered classroom that holds the students accountable for their choices and behavior in class. Along with, allows for development of a higher order of complex thinking.

Reaching Students through Teaching Strategies

It is critical for the opening day of class that teachers focus on “making connections” rather than “giving directions” (Kreizinger, 2006). The first few days of any course should create a positive and productive atmosphere for the upcoming year. Teachers need to get to know their students in that class. A teacher must develop a

relationship of trust before you create a teaching-learning relationship (Nunley, 2004).

Many of the students that come to class come from unstable homes. They are looking for a safe place where someone cares about them and what they do.

The three most critical and intertwining elements of the course should be “me,” “you,” and “content” (Kreizinger, 2006). “Me” being my credibility and my enthusiasm for the course content and the significance the course content has had for me and still has for me. Secondly, “you” being the student and what significance the course content will have for each student in the class. Hopefully, each student will build a sense of ownership in his or her education. Last of all, there is “content.” Having students develop a list of benefits that will come from being in this course will help students become better engaged in the course.

For many decades, research has been conducted to determine the most effective means of influencing learning experiences for all students. Teachers find themselves taking classes, attending seminars and conferences, reading journals and textbooks all for the purpose of maximizing the classroom learning experience. All this has contributed to the way teachers become most effective in classroom learning. However, the one most important means of determining how effective or ineffective learning experiences affect one’s personal experiences in the classroom is to ask the students. The authors Spencer and Boon (2006) decided to interview students with disabilities to explore their classroom learning experiences. Four students were asked to describe their most exciting and least exciting classroom experiences.

From the four interviews, it was concluded that teachers needed to display a sense of humor and a positive relationship with students. It was determined that a student’s relationship with the teacher reflected if he liked the course. One student spoke

of a first year teacher who was struggling with getting along with the students. The instructor decided to ask the students how she could create a more favorable learning environment. With that short little survey, she was better able to manage the class and help the students with their learning through the remainder of the school year (Spencer & Boon, 2006).

Other examples that students spoke of included learning experiences as being fun and nice. Nice was used to describe the teacher and fun to describe the learning experiences, which included hands on and group work, getting positive reinforcement, and connecting content to real-life experiences (Spencer & Boon, 2006).

Although generalizations cannot be made of the responses from just four students, the results from this survey should give teachers something to think about. In addition, teachers should value the opinion of student surveys from classroom observations and use it as constructive criticism.

As discussed above in the results provided by the four students in their interview, the role of the teacher is critical to the learning process. Charles R. Nuckles explained another example of how infrequently student interests or surveys are put to use in his article, *Student-Centered Teaching: Making It Work*. Given an assignment of teaching a new course at a technical school, the instructor asked students to complete an interest and background survey. One of the questions included, “Do you need help with tests, writing, or public speaking?” (Nuckles, 2000). One student response was “yes” to help on tests. With that, the student also wrote “Thank you. No one has ever asked before” (Nuckles, 2000). Why do teachers not ask their students what they need? An instructor needs to be focused on the needs of students or to be “student-centered” (Nuckles, 2000). Effective teaching revolves around a student-centered classroom whereby the learner is your main

focal point in the course or program. Teachers must maintain positive attitudes, behaviors, beliefs, and a value system that encourages student success..

Good human relation skills are important to good teaching. Messenger (1979), found that the characteristics which students used to rate their “best” teachers are sense of humor, understands students, makes learning interesting, explains clearly and thoroughly, relates to students, is available for help outside of class, treats student equally, and gets to know the student personally.

“For instructors whose aim is to empower participants with the desire and ability to guide their continued learning beyond the program, instructional mastery and style are intertwined components of the teaching/learning transaction” (Knox, 1986, p. 40).

Mastery of instruction allows the instructor to accomplish the objectives and to be student-centered to the learners. A responsible teacher engages in self-assessment of his or her content mastery. One must feel comfortable when questioned by a student, must not feel challenged nor should one act defensive. Content mastery should be a life-long learning process for every teacher.

Instructional style represents the way in which a teacher helps learners or a way in which a teacher is student-centered. Being student-centered is being proficient in integrating many teaching styles. It is a blending of a teacher’s preferred style with other styles, which lend themselves to the student’s learning process. One must engage in an ongoing evaluation of self and learners. This is a way of improving content and instructional mastery along with learner responsiveness.

Teachers need to be far more concerned then with just teaching course content. With the upcoming generation born after 1992 that represents 70 to 80 million people, meeting their educational needs proves to be an upcoming challenge. They are called the

“echo boomers” (McGlynn, 2006). This new generation poses a new challenge along with all the others challenges of teaching.

“Millennials want to learn by working collaboratively”, (McGlynn, 2005, p. 7). They prefer to learn on their time and on their terms. They prefer structured activities that are related to “real life” issues that matter to them. They pose a new challenge to teaching in keeping them actively engaged in activity. A recommendation to learning is using a “concerted active learning approach” (McGlynn, 2005, p. 7). Using examples that students can relate to is a way to create meaning between students’ life experiences and the material which we want them to be learning (McGlynn, 2005). These are but a few examples of teaching styles to be used with “echo boomers.”

Since the inclusion of students with disabilities has become a regular setting in the classroom, many times teachers are in the classroom alone with such a wide range of student abilities. These abilities can be diagnosed disabilities such as students with IEPs or students with physical disabilities. With whatever ability the student enters the classroom, it is the teacher’s responsibility to try to reach that student in order to provide a positive learning experience in that course. Other than the teacher trying to adopt new teaching strategies, a teacher can use a peer-assisted learning strategy (PALS) (Kroeger & Kouche, 2006) in order to assist the learning process in the classroom.

This classwide peer-tutoring approach (PALS) permits teachers to introduce curriculum and at the same time address the diverse group of abilities in a classroom. This strategy includes all students in the class and provides a means of coteaching. With the use of PALS as one type of instructional strategy, it provides students with the added benefit of developing social skills in a classroom setting along with their peers. Even

though PALS can be incorporated into the classroom, it should not be used as the only method of instruction (Kroeger & Kouche, 2006).

Many times students come in with the attitude they cannot perform at their expected grade level. Teachers will hear statements such as, “I never could do math, so why should I try,” “I’ve always failed math,” or “I just don’t get it.” With such a negative self-assessment, students tend to give up trying and continue on a downward slide. They disengage from the learning process and continue to add to their failures. As students withdraw or disengage from the learning process, students stop responding to any type of active learning and begin a negative behavior pattern in class, which causes disruption to the entire class (Kroeger & Kouche, 2006).

In order to address the issue of inclusion of students with disabilities careful planning by the instructor is required. In order to address the issue of student disengagement, an instructor needs to incorporate an instructional strategy to develop student cooperation. These strategies must challenge the embedded negative attitude students possess of themselves and develop desirable classroom behavior that facilitates classroom learning (Kroeger & Kouche, 2006).

The PALS strategy of learning challenges the teacher-centered or one-way teaching method so often used in a classroom. The method provides explicit roles for both teacher and students. PALS is “a way to enhance classroom practice, support inclusion, and directly confront what appeared to be a learned helplessness response of several of their students” (Kroeger & Kouche, 2006, p. 7). If administered closely, the response to PALS usage in the classroom by students can change attitudes, improve levels of achievement and reduce student anxiety.

Before implementing PALS as a teaching strategy, a set of instructional principles needs to be developed. These principles include clear and concise objectives, introducing only one concept at a time, review previously taught material, explicit explanations, provide time for practice and review and provide feedback.

The PALS classroom arrangement must begin with knowing the ability level of all students in the class. With this information known, a reciprocal pairing process by assessment is developed. With this type of pairing system, there is less disparity with ability levels of students. As the school year progresses it may be necessary to rearrange the pairings due to weaknesses and strengths that are developed through the PALS program.

The benefits to students are two fold. Not only do the students with the lower ability receive tutoring to help raise their achievement level but those students providing the tutoring get to practice on what they have learned and reinforce their knowledge of the material. Using this PALS method engages all students and creates a more student-centered atmosphere (Kroeger & Kouche, 2006).

With proper planning and administration of PALS, the process can yield many positive outcomes in the classroom. Examples of positive outcomes include the engagement of all students in the learning process, the rise in confidence levels and students becoming more active participants with the PALS program.

Making the Curriculum Relevant

Understanding learning styles and adopting teaching strategies to accommodate the different learning styles and student abilities is only half of the process for learning to occur. The other half involves the subject matter and the curriculum development for that

subject matter. Since the curriculum development of this project involves the subject matter of math, math along with curriculum development will be the focus in this discussion.

Any curriculum development must follow relevant criteria in order to assist students to achieve well in school mathematics. Curriculum development involves planning objectives, learning activities, and evaluation procedures that will be used in the math curriculum. Once these objectives, activities and evaluation procedures are developed a teacher should provide (a) meaningful learning activities for pupils, (b) interesting experiences in the school-class setting, and (c) purposeful as well as useful activities for learners (Ediger, 1978).

Students must understand and connect with the learning activities. In order for a student to develop a positive attitude and attach meaning, the curriculum should be adjusted to the achievement level and learning style of the learner. The student must be guided through the learning process so that there is an understanding of what is being taught. All learning activities should be meaningful. In addition, teaching aids should also be utilized in the learning process. Teaching aids should be used as a supplement to the actual teaching and should attach meaning to the learning activities. Learning activities should also help students develop a positive attitude toward learning.

Teachers must provide learning activities that are interesting to learners. Students learn much more readily if they find the subject matter more interesting to them. Taking the subject matter and applying it to a situation that a student can identify with will make the activity more interesting to the student. This becomes a relationship, which the learner can relate to, between the problem and the application (Ediger, 1978).

Finally, students should find purpose in their learning. It is important that learners find relevance in what they learn. Relevance includes being able to use the information as part of their every day activities. Seeing the relevance of the subject matter helps a student retain the learning longer by being able to apply the information on a daily basis (Ediger, 1978).

Mathematics has been considered a core academic subject taught in a comprehensive school. Teachers have had a tendency to teach their subject matter with a closed-door policy. Math has been taught as a subject matter with no technical applications. In recent years career and technical education teachers have had to look at the need to integrate core academics such as math into their program areas. It is essential the CTE programs integrate these core subjects in order to maintain their existence (Ediger, 1978).

Two national studies—one by ASTD, the American Society for Training and Development (Carnevale, Gainer, & Meltzer, 1990) and one by the Secretary's Commission on Achieving Necessary Skills (SCANS, 1991)—are works in identifying employability skills, often used as beginning points for other international, national, state, regional, and local studies (Overtom, 2000). In the studies they investigate not only what is required in the workplace of today and tomorrow, but also determine the extent to which high school students are able to meet the needs of employers. Across the board it is found that the basic competency skills—reading, writing, computation (math), among others, are the skills currently needed for employment as desired by employers (Overtom, 2000).

Integration of core academics and CTE training develops a positive connection between academics and CTE disciplines. CTE disciplines can now apply a math

curriculum to real-life problem-based activities whereby students can see the relevance of math in their subject area and how it applies to industry. With the application of a core subject such as math and this positive connection, no longer is math relegated to rote memorization. Practical applications can now take a front row seat (Overtoom, 2000).

In order to integrate academics and CTE training certain questions must first be answered: “(a) How are the curricular contents intertwined? (b) Where do areas of commonality exist? (c) Why is the content important/relevant? And (d) How will the content be covered in a timely, related fashion?” (Zirkle, 2004, p. 20). Once these questions have been answered, effective curriculum structuring between academics and CTE can begin.

With today’s increased emphasis on academics and No Child Left Behind (NCLB), it is imperative that CTE integrates their programs with the necessary academics. This will develop a connection between CTE and the academic areas, which is where the resources are presently being allocated with NCLB.

To demonstrate the integration of academics and CTE training in 1999 under the leadership of DePaul University, the Chicago Public School, City Colleges of Chicago, business, labor and community organizations were brought together to initiate an educational reform that would improve academic and career outcomes for students. This initiative resulted in the Built Environment Partnership, which developed standards known as the *Construction Cluster Skill Standards*. These standards lay the framework for students for entry-level job requirements, apprenticeships or post-secondary education in a related field. These clusters integrate both the academics and technical training needed for advancement or for career transferability (DePaul University, 1999).

The core academic standards include the mathematical operations, measurement, algebraic and geometric methods to solve real world problems. The ten standards listed include simple operations, decimals and fractions, measurements, perimeter, circumference, area and volume, algebraic concepts, ratio, percent and proportion, charts, tables, graphs, and arithmetic operations in calculating wages after taxes, budget and checkbook management. These math core academics are competencies that are needed across the board from the entry-level employees to professionals in large companies.

CHAPTER III

RESEARCH PROJECT

The primary objective of this project is to develop a one-semester math curriculum for students of the carpentry program at TCD. The course will consist of math units that apply to the construction field. In an effort to prepare students for an entry-level carpentry position or apprenticeship, the problems will be realistic, practical, and typical of the types of calculations that builders can expect to encounter in practice.

The curriculum will be written to meet the needs of a wide range of learning abilities and learning styles in a diverse classroom population. Yet, it will encourage students to work at their maximum ability. In order to accommodate the needs of all students in the classroom, a differentiated curriculum will be developed for use in this project. Developing a differentiated curriculum is a three-step process.

To develop this curriculum one must begin by differentiating content, process and product. The first area, content involves finding areas of study within the unit that will increase the student's interest in learning. Second area, process will include developing different ways of learning and completing assignments. Third area, product will be to demonstrate what has been learned. This product can be in the form of an assignment, quiz, test, or oral defense. In the end, the student will demonstrate what new knowledge has been learned (Nunley, 2006).

Once these three pieces have been developed the curriculum can be separated into three separate blocks, which become a Layered Curriculum™: a teaching method that breaks the learning into three distinct levels based on the complexity of the student's thought process (Nunley, 2006). These elements must be present in order to be considered a true Layered Curriculum™: choice, critical thinking, and accountability.

Once this has been developed, grades can be assigned to the different layers of learning. The bottom layer is the C layer. This layer gathers basic information and provides the student with an opportunity to get a general understanding of the topic within the unit of study. It is the rote learning of facts, vocabulary and skills whereby the student demonstrates the basic understanding of materials learned. The middle layer is the B layer. This layer has the student apply and manipulate the information learned in this unit. It also allows the student to link this new information to information already learned. This layer does not require more work, it requires thinking that is more complex and allows the student to apply and manipulate the knowledge acquired in the C layer. The top layer is the A layer. This layer encourages the student to critically analyze the subject in this unit. Critical thinking requires a higher level of thinking and it teaches how to develop the process of critical thinking. The critical thinking applied at this level should reflect the real world issues of today.

The model best suited for technical or task oriented classes is the Layered Curriculum™ Achievement Levels as shown in Figure 1. All the elements of the Layered Curriculum™ are still present but the main bulk of the layered curriculum emphasizes the middle layer, which is the hands on (application/manipulation) section. It allows the students in the CTE program to demonstrate their ability to perform the task of a hands-on shop activity in order to convey the knowledge acquired in the B layer.

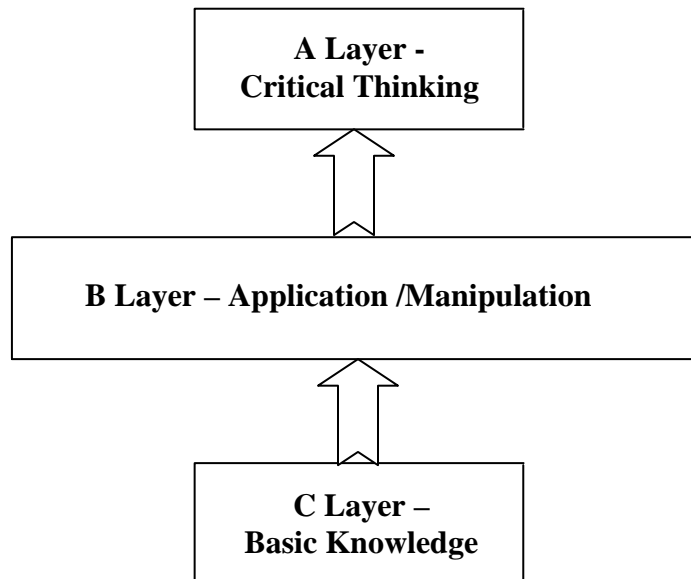


Figure 1. Layered Curriculum™ Achievement Levels

Note. From *Layered Curriculum™* (p. 54), by K. F. Nunley, 2004, Kearney, NE: Morris Publishing. Copyright 2004 by K. F. Nunley. Adapted with permission.

Appendices

Each appendix that follows represents a vital element of the curriculum that is required of the Construction Trades Program at the Technology Center of DuPage. One must be aware of the fact that the curriculum has been developed for immediate application in the program area. This program curriculum is an ongoing program that will be evaluated and reevaluated during the academic year. Elements will be added, removed, and expanded upon as a response to the students' interests and achievements.

Appendix A shows the timeline of 13 weeks for the program. Since this program will be integrated into the school year it will not run in a successive 13-week period, it will be integrated throughout the school year. Each unit is based on a one-week completion time. The skills for each unit have been listed for the students. This skill

awareness enables students to know what skills they need to successfully master in order to complete each unit.

Since the inception of state learning standards, all academic programs must be aligned with these academic standards. CTE programs are no exception to this rule. With the reauthorization of the Carl Perkins Act, CTE programs are being held more accountable for the necessary academic skills needed for entry-level employment. Therefore, the Illinois Learning Standards for Mathematics have been aligned with each unit of the mathematics program along with the assessments for which students will be graded.

With the introduction of a Layered Curriculum™ for the mathematics program, the worksheets in Appendix B list a variety of activities for each student to choose and complete. Each student will be responsible to choose the activities that interest or suit their liking and must earn the required number of points for each level. So that students are aware of where they stand in point accumulation, space has been provided for students to list the points earned on their own worksheet. The instructor will also keep a record of points accumulated for each student.

Not only is it necessary for students to be aware of the skills they need to master to be successful, they also need to be provided a list of what they will be accountable for on each assignment and test they will have to complete. Appendix C provides a rubric for each assignment that has to be completed and a grading scale for each worksheet and unit test.

In order for an instructor to assess the achievement level of students in a program, there needs to be a device that measures the entry level and the completion level of each student in a program. Appendix D provides a pre-test and post-test for this purpose. In

order to see how students are progressing through the program and to see where additional help may be needed, unit tests will be given to guide students along.

Since classrooms have become student-centered, the focus of the instruction is based on the needs of the students. Therefore, their input is a vital component to a successful course of study. Appendix E provides a course evaluation for students at the completion of the mathematics program. The results of this evaluation will determine the needed changes in the course.

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APPENDIX A
TIMELINE, CONTENT AND SKILLS
ILLINOIS LEARNING STANDARDS FOR MATHEMATICS AND
ASSESSMENTS

LAYERED CURRICULUM™ TIMELINE

Developing Basic Math Skills for Successful Apprentices

<u>Timeline</u>	<u>Content</u>	<u>Skills</u>
Week 1	Whole Numbers	<ul style="list-style-type: none"> ▪ Read and write the mathematical signs and abbreviations used in carpentry. ▪ Solve basic problems in addition, subtraction, multiplication and division using whole numbers. ▪ Solve problems using the proper order of operations. ▪ Pass with 70% or better a 20 question, 6 minute timed test on whole numbers.
Week 2	Fractions	<ul style="list-style-type: none"> ▪ Read a carpenter's rule. ▪ Solve basic problems in addition, subtraction, multiplication and division using fractions and mixed fractions. ▪ Reduce fractions to lowest common denominators. ▪ Order fractions according to size. ▪ Change improper fractions to mixed numbers and vice versa.
Week 3	Decimal Fractions	<ul style="list-style-type: none"> ▪ Identify the place value of a decimal fraction. ▪ Solve problems involving addition, subtraction, multiplication and division of decimal fractions. ▪ Convert common fractions to decimal fractions and vice versa. ▪ Convert mixed decimals to mixed fractions and vice versa. ▪ Pass with 70% or better a 40 question, 12 minute timed test on fractions and decimal fractions.
Week 4	Percent and Percentages.	<ul style="list-style-type: none"> ▪ Demonstrate an understanding of percent. ▪ Convert decimals and fractions to percents. ▪ Convert percents to decimals and fractions. ▪ Setup and solve for the unknown involving a problem with amount, percent and base. ▪ Set up and solve word problems involving percent.

Week 5	Angles, Triangles and Pythagorean Theorem	<ul style="list-style-type: none"> ▪ Solve right triangles using the Pythagorean Theorem. ▪ Solve for the area of right triangles, 3-4-5 and 5-12-13 right triangles. ▪ Pass with 70% or better a 15 question, 10 minute timed test on right triangles.
Week 6	Area and Perimeter	<ul style="list-style-type: none"> ▪ Find the perimeter and area of a rectangle and square. ▪ Find the circumference and area of a circle. ▪ Determine the area and perimeter of composite figures. ▪ Pass with 70% or better a 6 question, 7 minute timed test on area and perimeter.
Week 7	Footings, Foundations and Slabs	<ul style="list-style-type: none"> ▪ Calculate the amount of concrete required for a foundation footing. ▪ Calculate the amount of concrete required for a foundation wall. ▪ Calculate the amount concrete required for a slab. ▪ Pass with 70% or better a 6 question, 7 minute timed test on calculating concrete.
Week 8	Girders, Sill Plates Bridging, Floor Joists, and Floor Covering	<ul style="list-style-type: none"> ▪ Determine the material list and calculate the material needed for a built-up girder. ▪ Determine the material list and calculate the material needed for all sill plates. ▪ Determine the material list and calculate the number and length of floor joists and floor joist headers for a particular framing plan. ▪ Determine a material list and calculate the amount of floor covering needed for an area. ▪ Pass with 70% or better an 8 question, 9 minute timed test on total materials.
Week 9	Wall Framing	<ul style="list-style-type: none"> ▪ Calculate the number of studs needed to frame the exterior walls of a structure using 16" on center. ▪ Calculate the number of studs needed to frame the interior walls of a structure using 16" on center. ▪ Calculate the amount of material needed for the bottom, top and double top plates. ▪ Pass with 70% or better a 6 question, 7 minute timed test on framing.

Week 10	Common Rafters and Framing Square	<ul style="list-style-type: none">▪ Demonstrate the use of a framing square to locate the unit line length for a given slope.▪ Calculate the unit rise, unit run and unit length of a rafter.▪ Calculate the total rise, total run and total length of a rafter.▪ Determine the slope of an existing roof by means of the direct or indirect method.▪ Pass with 70% or better an 8 question, 9 minute timed test on calculating line length of a rafter.
Week 11	Interior and Exterior Wall and Roof Covering	<ul style="list-style-type: none">▪ Determine the amount of materials needed to close in the exterior walls.▪ Determine the amount of various types of siding needed to cover the exterior of a house.▪ Determine the amount of drywall needed for the interior of a house.▪ Determine the amount of materials needed to sheath a roof.▪ Determine the amount of material (felt paper, drip edge, shingles) needed for a roof.▪ Pass with 70% or better a 10 question, 12 minute timed test on calculating materials.
Weeks 12 and 13	The Estimating Process	<ul style="list-style-type: none">▪ Given a set of blueprints prepare a materials list for construction of a residence.

LAYERED CURRICULUM™ TIMELINE

Illinois Learning Standards and Assessments

<u>Timeline</u>	<u>Illinois Learning Standards Mathematics</u>	<u>Assessments</u>
Week 1	Whole Numbers 6A, B and C 8C and D	Lecture Participation Math Assignments Vocabulary-Oral Defense Board Game Development Problem Solutions Poster Creation Written Report Written Test
Week 2	Fractions 6A, B and C	Lecture Participation Math Assignments Worksheet Test Construction Presentation Chart Development Written Report
Week 3	Decimal Fractions 6A, B, C and D	Lecture Participation Math Assignments Flash Cards-Oral Defense Poster Creation Test Construction Problem Solutions Written Report Written Test
Week 4	Percent and Percentages 6A, B and C	Lecture Participation Math Assignments Poster Creation Demonstration Problem Solutions Math Conversions-Oral Defense Math Puzzle Written Report Written Test

Week 5	Angles, Triangles and Pythagorean Theorem 6A and B 7A and C 8C and D 9A, B and D	Lecture Participation Math Assignments Poster Creation Problem Solutions Building Projects Blueprint Assignment Written Report Written Test
Week 6	Area and Perimeter 6A, B and C 7A and C 9A, B and C	Lecture Participation Math Assignments Floor Plan Creation Problem Solutions Poster Creation Written Report Written Test
Week 7	Footings, Foundations and Slabs 6B 7A, B and C 9A	Lecture Participation Math Assignments Video and Notes Vocabulary-Oral Defense Poster Creation Building Projects Written Report Written Test
Week 8	Girders, Sill Plates, Bridging, Floor Joists, and Floor Covering 6B and C A, B, and C	Lecture Participation Math Assignments Video and Notes Vocabulary-Oral Defense Building Projects Written Report Written Test
Week 9	Wall Framing 6D 7A, B and C	Lecture Participation Math Assignments Video and Notes Vocabulary-Oral Defense Poster Creation Drawing Project Floor Plan Written Report Written Test

Week 10	Common Rafters and Framing Square 6A and B 7B and C 8D 9A and D	Lecture Participation Math Assignments Video and Notes Vocabulary-Oral Defense Poster Creation Drawing Project Floor Plan Written Report Written Test
Week 11	Interior and Exterior Wall and Roof Covering 6C 7B 9A	Lecture Participation Math Assignments Poster Creation Roof Project Drywall Project Written Report Written Test
Week 12 and 13	The Estimating Process 6C and D 7A, B and C 10A and B	Completion of: Work Sheet Estimate Summary Take-Off

APPENDIX B
WORKSHEETS

NAME: _____

WORKSHEET NO. 1

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 1-Whole Numbers

Skills

- Read and write the mathematical signs and abbreviations used in carpentry.
- Solve basic problems in addition, subtraction, multiplication and division using whole numbers.
- Solve problems using the proper order of operations.
- Pass with 70% or better a 20 question, 6 minute timed test on whole numbers.

C Layer

Day 1 Math Signs and Abbreviations

No more than 25 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Using 3 x 5 cards or paper, write the math sign or word on the front and a simple definition on the back. The definitions must be in your own words (not copied out of the book). | 10 Points | _____ |
| 3. | Textbook: <i>Mathematics for Carpenters</i>
Page 4, Application
Problems 2, 4, 6, 8 and 10 | 10 Points | _____ |
| 4. | Develop a board game using the math signs and abbreviations on the attached list. | 10 Points | _____ |

Day 2 Addition, subtraction, multiplication and division of whole numbers

Complete no more than 20 points

- | | | | |
|-----|--|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook assignment | | |
| | a. Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 2, Place value for whole numbers
Exercise 1-1A and 1-1B | | |

- b. Textbook: *Mathematics for Carpenters*
Pages 9-11, Application
Problems 1, 2, 6 and 8
- c. Textbook: *Mathematics for Carpenters*
Pages 15 and 16, Application
Problems 2, 4 and 10
- d. Textbook: *Mathematics for Carpenters*
Page 20 Application
Problems 1, 2, 4 and 6
- e. Textbook: *Mathematics for Carpenters*
Page 25 Application
Problems 2, 4, 6, 8, 10, 12 and 14 5 Points _____
3. Textbook assignment using a calculator
- a. Textbook: *Practical Problems in Mathematics for Carpenters*
Pages 1-2 Practical Problems
All even numbered problems 2-20
- b. Textbook: *Practical Problems in Mathematics for Carpenters*
Pages 6-8 Practical Problems
All even numbered problems 10-30
- c. Textbook: *Practical Problems in Mathematics for Carpenters*
Pages 10-12 Practical Problems
All even numbered problems 8-28
- d. Textbook: *Practical Problems in Mathematics for Carpenters*
Pages 13-15 Practical Problems
All even numbered problems 2-28 5 Points _____
4. Develop a poster showing place value for whole numbers. 5 Points _____
- Day 3 Order of Operations
Complete no more than 15 points
- *1. Listen to lecture and take notes. 5 Points _____
2. Textbook: *Practical Problems in Mathematics for Carpenters*
Pages 17-18 Practical Problems
Problems 1-21 5 Points _____
3. Textbook assignment using a calculator
Textbook: *Mathematics for Carpentry and the Construction Trades*
Pages 11-12 Calculator Practice Exercises
All even problems 5 Points _____
4. Develop a poster showing place value for order of operations. 5 Points _____

B Layer-Complete no more than 20 points

1. Without getting out of your seats and counting individually, how many full ceiling tile openings (2' x 4' openings and lights count as an opening) are in the classroom and office area ceiling?

Explain in one paragraph (at least 6 sentences) how you came up with your answer.

10 Points _____

2. Using the tile count for the answer in problem number one, what is the width and length of the classroom and office area combined. In addition, what is the total perimeter of this same area?

Explain in one paragraph (at least 6 sentences) how you came up with your answer.

10 Points _____

3. Using the answers given in problem number two, how many of your shoes would it take to stretch lengthwise and how many of your shoes would it take to stretch widthwise to cover the measurements?

Explain in one paragraph (at least 6 sentences) how you came up with your answer.

10 Points _____

4. Using the scale $\frac{1}{4}'' = 1'-0''$, draw the floor plan of a house which has a perimeter of exactly 272'. The house must have at least eight sides (no less).

10 Points _____

A Layer-Complete no more than 20 points

1. Type a one-page paper on why math is so important to the construction trades. If typed, the paper must be at least three paragraphs, double-spaced with one-inch margins on all sides. If you decide to write the paper, it must be a two written pages with at least three paragraphs.

You will be graded on spelling, punctuation and grammar in addition to the quality of your paper (see grading rubric for further information).

20 Points _____

2. If you were given a floor plan of a 6 room ranch style house with outside dimensions of 24' x 48', how many days would it take to complete the building of this house? The house will have a kitchen, dining room, living room (great room), 3 bedrooms, and 1 ½ baths. It will be built on a concrete slab with a 5/12 gable roof and will have vinyl siding. Assume all materials are on time and no weather delays.

You must break down the building days by subcontractor such as excavation, concrete, framing etc. and indicate the number of days each subcontractor will take to complete his job. Your final answer will reflect the total number of days to completion.

20 Points _____

NAME: _____

WORKSHEET NO. 2

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 2-Fractions

Skills

- Reading a carpenter's rule.
- Solve basic problems in addition, subtraction, multiplication and division using fractions and mixed fractions.
- Reduce fractions to lowest common denominator.
- Order fractions according to size.
- Change improper fractions to mixed numbers and vice versa.

C Layer

Day 1 Reading a carpenter's ruler

Complete no more than 10 points

- | | | | |
|-----|---|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Worksheet: Complete the attached Reading a Carpenter's Ruler Activity A, Problems 1 and 2 | 5 Points | _____ |

Day 2 Reduce fractions to lowest common denominator.

Complete no more than 20 points

- | | | | |
|-----|---|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 16, Exercise 2-1A, Problems 1-10 | 5 Points | _____ |
| 3. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 17, Exercise 2-1B, Problems 1-10 | 5 Points | _____ |
| 4. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 23, Exercise 2-2A, Problems 1-20 | 5 Points | _____ |

Day 2 Change improper fractions to mixed numbers and vice versa.
Complete no more than 10 points

1. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 19, Exercise 2-C, Problems 1-10 5 Points _____
2. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 20, Exercise 2-1D, Problems 1-10 5 Points _____

Day 3 Addition, subtraction, multiplication and division using fractions and mixed fractions.
Complete no more than 25 points

- *1. Listen to lecture and take notes. 5 Points _____
2. Textbook: *Mathematics for Carpentry and the Construction Trades*
Pages 29-30, Exercise 2-3, Even problems 2-18 5 Points _____
3. Textbook: *Mathematics for Carpentry and the Construction Trades*
Pages 34-35, Exercise 2-4, Even problems 2-20 5 Points _____
4. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 40, Exercise 2-5, Even problems 2-20 5 Points _____
5. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 43, Exercise 2-6, Even problems 2-20 5 Points _____

Day 4 Order fractions according to size.
Complete no more than 5 points

1. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 25, Exercise 2-2B, Problems 1-20 5 Points _____

B Layer-Complete no more than 20 points

1. Construct a time test with 20 problems from the units studied in this section. Choose 2-3 classmates to complete the tests and time them three times during the week. Using a bar graph, show their progress and explain their success to me.

20 Points _____

2. Prepare a class presentation on fractions. Some of the topics to be included in your presentation are numerator, denominator, equivalent fractions, adding fractions, adding fractions with different denominators. You may add to this list by including subtraction, multiplication and division. Your presentation must be at least 10 minutes and you must turn in an outline of your presentation. If you choose to do this activity, you may bring in edible food for your demonstration.
20 Points _____

A Layer-Complete no more than 20 points

1. Type a half-page paper of why it is so important that measurements are to the exact fraction of an inch in the construction trades. If typed, the paper must be at least two paragraphs (13 typed lines), double-spaced with one-inch margins on all sides. If you decide to write the paper, it must be a one-page hand written paper with at least two paragraphs.

You will be graded on legibility, spelling, punctuation and grammar in addition to the quality of your paper (see grading rubric for further information).

20 Points _____

2. Make a chart showing the different scales on a triangular architect's scale in comparison to a one-foot reference. Start with the smallest scale first to the largest. Using a set of blueprints, indicate next to each scale on the chart what plans are drawn to that scale.

20 Points _____

NAME: _____

WORKSHEET NO. 2

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 2-Reading a Carpenter's Ruler

1. Draw an arrow above the picture of the ruler to identify the measurement given below. Write the corresponding letter of the alphabet above the arrow.

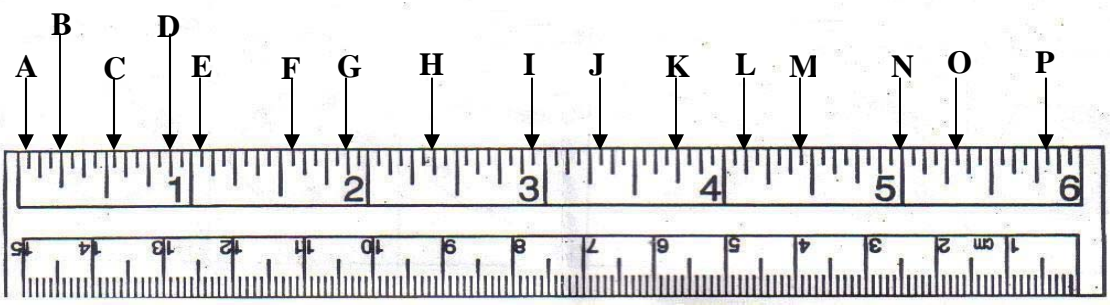
A. $3/16$ "E. $1\ 3/4$ "I. $3\ 7/8$ "B. $7/16$ "F. $2\ 1/2$ "

J. 4"

C. $15/16$ "G. $2\ 13/16$ "K. $4\ 9/16$ "D. $1\ 1/4$ "H. $3\ 1/8$ "L. $5\ 1/16$ "

2. What measurement does each of the locations A to P on the ruler indicate? Give each answer as a mixed number reduced to lowest terms.

- | | | |
|----------|----------|----------|
| A. _____ | F. _____ | K. _____ |
| B. _____ | G. _____ | L. _____ |
| C. _____ | H. _____ | M. _____ |
| D. _____ | I. _____ | N. _____ |
| E. _____ | J. _____ | O. _____ |
| | | P. _____ |



NAME: _____

WORKSHEET NO. 3

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 3-Decimal Fractions

Skills

- Identify the place value of a decimal fraction.
- Solve problems involving addition, subtraction, multiplication and division of decimal fractions.
- Convert common fractions to decimal fractions and vice versa.
- Pass with 70% or better a 40 question, 12 minute timed test on fractions and decimals.

C Layer

Day 1 Identify the place value of a decimal fraction
Complete no more than 10 points

- | | | | |
|-----|--|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 53, Exercise 3-1, Problems 1-12 | 5 Points | _____ |

Day 2 Addition, subtraction, multiplication and division of decimal fractions.
Complete no more than 20 points

- | | | | |
|-----|--|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook assignment | | |
| a. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 54-55, Exercise 3-2
All even problems 2-20 | | |
| b. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 56-57, Exercise 3-3
All even problems 2-20 | | |
| c. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 59, Exercise 3-4
All even problems 2-18 | | |

- d. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 61, Exercise 3-5
All even problems 2-20

15 Points _____

Day 3 Convert common fractions to decimal fractions and vice versa.
Complete no more than 30 points

- *1. Listen to lecture and take notes. 5 Points _____
2. Textbook assignment
- a. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 67, Exercise 3-7A
All even problems 2-46
- b. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 70-71, Exercise 3-7B
All problems 1-25

5 Points _____

3. Make flash cards for the eight basic fractions with their decimal equivalent on the back. Those fractions include $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and 1. Learn them all and be prepared to tell me all of them.

15 Points _____

4. Make a poster showing the steps to change a fraction to a decimal.

5 Points _____

5. Make a poster showing the place value of a decimal. On the poster you must show the place values four places to the left of the decimal and four place to the right of zero.

5 Points _____

B Layer-No more than 20 points

1. Construct a time test with 20 problems from the units studied in this section. Choose 2-3 classmates to complete the tests and time them three times during the week. Using a bar graph, show their progress in percent form and explain their success to me.

20 Points _____

2. Measure all the tables in the classroom and convert that measurement to a decimal equivalent. Measure the classroom and convert that measurement to a decimal equivalent. Show the comparison of room size to table space in the classroom.

20 Points _____

A Layer-No more than 20 points

1. In the sports section of the newspaper, take any baseball player find out his ERA. Write a half to one page summary of how that ERA was computed.
20 Points _____

2. Which way would be considered more precise in presenting numerical information? Would that expression be in fractions or decimals? Support your position with 2-3 examples. Interview 1-2 classmates to get their views on these questions. Write a half page summary to support your findings.
20 Points _____

NAME: _____

WORKSHEET NO. 4

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 4-Percent and Percentages

Skills

- Demonstrate an understanding of the meaning of percent.
- Convert decimals and fractions to percents.
- Convert percents to decimals and fractions.
- Set up and solve word problems involving percent.

C Layer

Day 1 Demonstrate an understanding of the meaning of percent.

Complete no more than 25 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Practical Problems in Mathematics for Carpenters</i>
Page 62-64, Practical Problems
All even problems 2-30 | 5 Points | _____ |
| 3. | Make a poster explaining the basic principle of percent. Use the poster to explain to me what percent means. | 5 Points | _____ |
| 4. | Make a poster explaining the basic principle of percent. Use the poster to explain to the class what percent means. | 10 Points | _____ |
| 5. | Bring in a round edible object. Demonstrate 5 different percentages of that object. | 5 Points | _____ |
| 6. | Find the percentage of each color in a bag of skittles. | 5 Points | _____ |

Day 2 Convert decimal and fractions to percents and percents to decimals and fractions.

Complete no more than 30 points

- | | | | |
|-----|---|----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 111-112, Exercise 6-1, Problems 1-20 | 5 Points | _____ |

3. Using 3 x 5 cards or paper, write on the front side the formula for converting a decimal to a percent, a fraction to a percent, a percent to a decimal and a percent to a fraction. On the back side write the step by step procedure for converting. 10 Points _____
4. Create a math puzzle using the conversion formulas of converting a decimal to percent, fraction to percent or vice versa. 5 Points _____
5. Find out the partner school that each student in the class comes from. Determine the percentage they represent from that school. Convert the percentage to a decimal equivalent and a fraction equivalent. Setup the problem as a word problem and show how you solved the problem. You must show all your work in order to earn credit. 15 Points _____

B Layer-Complete no more than 20 points

1. If you have an 8' x 8' wall with no openings, what percentage does one stud represent in that wall. Set it up as a word problem and show all your work on how you solved the problem. 20 Points _____
2. What percentage of space does your body occupy in this room? How many people of your size fit into the room? 20 Points _____

A Layer-Complete no more than 20 points

1. Explain how percentages are important in sports. Write a half to one page summary of your findings. 20 Points _____
2. What is the best way to present numerical information in today's world as either fractions, decimals or percents? Support your position with 2-3 examples. Interview 1-2 classmates to get their views on these questions. Write a half page summary to support your findings. 20 Points _____

3. Look in magazines or newspapers for 5-7 store ads that use percents and convert them to decimals and fractions. Determine the amount of savings for these ads. Rewrite the ads using fractions instead and ask two adults which is the better deal, the fraction or percent sale and why. Record their responses and be prepared to explain it to me.

20 Points _____

NAME: _____

WORKSHEET NO. 5

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 5-Angles, Triangles and Pythagorean Theorem

Skills

- Solve right triangles using the Pythagorean Theorem.
- Solve problems involving right triangles, 3-4-5 and 5-12-13.
- Pass with 70% or better a 15 question, 10 minute timed test on right triangles.

C Layer

Day 1 Solve right triangle using the Pythagorean Theorem

Complete no more than 25 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 134, Exercise 7-3A
All problems 1-20 | 5 Points | _____ |
| 3. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 136, Exercise 7-3B
All problems 1-13 | 5 Points | _____ |
| 4. | Make a poster explaining the basic principles of the Pythagorean Theorem and how to solve the equation for any side. | 10 Points | _____ |
| 5. | Make a poster showing four different types of triangles, identify the degrees of the angles and show the sum of the three inside angles in each triangle. | 10 Points | _____ |

Day 2 Solve problems involving right triangles, 3-4-5 and 5-12-13

No more than 30 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 139-140, Exercise 7-4, Problems 1-15 | 5 Points | _____ |
| 3. | Make a poster showing how to use the multiples of the 3-4-5 in order to check for square in a foundation and wall. | 10 Points | _____ |

4. Given a span of 24'-0" create a poster showing the correct angle, height and length of the triangles for 4" rise-12" run, 6" rise-12"run, 8"rise-12"run and 9"rise-12"run, use the scale 1"=1'-0".
10 Points _____
5. Textbook: *Mathematics for Carpentry and the Construction Trades*
Page 144-145, Exercise 7-5, Problems 1-15 5 Points _____
6. Make a poster showing a foundation layout with a measurement of 24'-0" x 32'-0". In the drawing show the batter boards, outline of the foundation and strings showing how you would check for square.
10 Points _____

*B Layer-Choose one

1. Using 1" x 3" material in the shop cut and build the four different types of triangles, which include the right triangle, equilateral triangle, isosceles triangle and scalene triangle. Indicate all inside angles and the total sum of the inside angles for each triangle.
25 Points _____
2. Common shapes that are essential to carpentry work include the rectangle, square, triangle and circle. Using any material in the shop, create all four shapes indicating the inside angles and the total of the inside angles.
20 Points _____
3. Choose a set of five different blueprints with five different roof pitches. From the information given and using a scale of 1"=1'-0", draw the altitude, base and hypotenuse of the triangle that represents the roof section.
20 Points _____

*A Layer-Choose one

1. Write a one-page report on Pythagoras.
25 Points _____
2. Write a one-page report on the application of the Pythagorean Theorem in the real world of today.
25 Points _____
3. Write a report explaining and showing the relationship between the Pythagorean Theorem and a baseball diamond?
20 Points _____

*Both layers A and B must have a combined total of 45 points.

NAME: _____

WORKSHEET NO. 6

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 6-Area and Perimeter

Skills

- Find the perimeter and area of a rectangle and square.
- Find the circumference and area of a circle.
- Determine the area and perimeter of composite figures
- Pass with 70% or better a six question, 7 minute times test on area and perimeter.

C Layer

Day 1 Find the perimeter and area of a rectangle and square.

Complete no more than 25 points

- | | | | |
|-----|--|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 156-157, Exercise 8-1
Problems 1-2, 5-9, 13-25 | 5 Points | _____ |
| 3. | Draw a floor plan of a house that has a perimeter of 260'. The floor plan must have at least six sides. Indicate all dimensions. Use a 1/4" scale. Calculate its surface area. | 5 Points | _____ |
| 4. | Draw a floor plan of a house that has a perimeter of 320'. The floor plan must have no less than eight sides. You must include a square, rectangle and a bow or bay shape in the floor plan. Use a 1/4" scale. Calculate its surface area. | 10 Points | _____ |
| 5. | Create at least 5 different shapes with a perimeter of 73'. No forms of a circle are allowed. | 10 Points | _____ |
| 6. | What is the perimeter of the Bear's playing field and what is its surface area calculation? | 5 Points | _____ |

Day 2 Find the circumference and area of a circle.

Complete no more than 30 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 165-168, Exercise 8-2, Problems 1-24 | 5 Points | _____ |
| 3. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 174-177, Exercise 8-4, Problems 1-20 | 5 Points | _____ |
| 4. | Using 5 pictures from a magazine, create a poster showing why it is important for a carpenter to know the circumference and area formulas of a circle. | 10 Points | _____ |
| 5. | Draw a floor plan of a house that has a perimeter of 260'. The floor plan must have at least 6 sides and must include a tower on one corner of the floor plan. Indicate all dimensions. Use a 1/4" scale. Calculate its surface area. | 10 Points | _____ |
| 6. | Create a shape whose area is twice its perimeter. | 5 Points | _____ |

*B Layer-Choose one

- | | | | |
|----|--|-----------|-------|
| 1. | Draw the floor plan of the shop area using a 1/4" scale and indicate all perimeter measurements. Figure the surface area of the shop. You must show all work. | 20 Points | _____ |
| 2. | Measure and draw a floor plan of the shop area using a 1/4" scale and indicate all perimeter measurements. Figure the surface area of the shop and the surface area of the big house. Calculate the what percentage the house represents in relationship to the shop area. | 25 Points | _____ |

*A Layer-Choose one

1. Write a one-page report on why knowing the square footage is important to an architect.
20 Points _____

2. Figure out the perimeter and area of the entire playing field at Cub's Park or White Sox's Park. For each park figure out the area enclosed by home, first, second and third base and determine what percentage this area is in relationship to the entire playing field. Write a one-page report on your findings.
25 Points _____

*Both layers A and B must have a combined total of 45 points.

NAME: _____

WORKSHEET NO. 7

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 7-Foundations and Slabs

Skills

- Calculate the amount of concrete required for a foundation footing.
- Calculate the amount of concrete required for a foundation wall.
- Calculate the amount of concrete required for a slab.
- Pass with 70% or better a 6 question, 7 minute timed test on right triangles.

C Layer-Complete no more than 25 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 225, Review Exercise 1-4 | 5 Points | _____ |
| 3. | Watch the video on concrete and take notes. | 5 Points | _____ |
| 4. | On 3" x 5" cards or paper define the following terms:
green concrete, portability, Portland cement, hydration,
air-entraining cement, aggregate, coarse aggregate, admixtures,
RCC (roller-compacted concrete), expanded plastic cell slabs,
slump test, cement dermatitis. | 10 Points | _____ |
| 5. | Make a poster board showing the different types of piers
used in concrete foundations. | 10 Points | _____ |

B Layer-Complete no more than 15 Points

- | | | | |
|----|--|-----------|-------|
| 1. | Using a 1/2" scale, construct the foundation forms used to pour a foundation system for any of the floor plans shown on page 226 of your textbook. Use the styrofoam material provided in class. | 15 Points | _____ |
|----|--|-----------|-------|

2. With the materials provided to you and using a 1/2" scale, layout batter boards with the building lines attached to show the building lines. The layout should be for a 12'-0" x 24'-0" building. 15 Points _____

A Layer-Complete no more than 20 Points

1. Write a report explaining the insulation properties of concrete. 20 Points _____
2. Research the properties of building a residential home from concrete. Write a report on your findings. 20 Points _____

NAME: _____

WORKSHEET NO. 8

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 8- Girders, Sill Plates, Bridging, Floor Joists and Floor Covering

Skills

- Determine the material list and calculate the material needed for a built up girder.
- Determine the material list and calculate the material needed for all sill plates.
- Determine the material list and calculate the number and length of floor joist and floor joist headers for a particular framing plan.
- Determine the material list and calculate the amount of floor covering material needed for a certain area.
- Pass with 70% or better an eight question, 9 minute timed test on total materials.

C Layer-Complete no more than 20 points

- | | | | |
|-----|--|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 237, Review Exercise 1-3 | 5 Points | _____ |
| 3. | Watch the video on supports and take notes. | 5 Points | _____ |
| 4. | Watch the video on floor framing and take notes. | 5 Points | _____ |
| 4. | On 3" x 5" cards or paper define the following terms:
girder, joists, header joists, butt joints, load bearing, sill plates,
floor joists, span, bridging, subflooring and OSB | 10 Points | _____ |

B Layer-Complete no more than 15 Points

- | | | | |
|----|--|-----------|-------|
| 1. | Using lattice material and a 1/2" scale, show how you would build a girder using three pieces of lumber and bolting them together for a residential building that is 40' long. You must show the splices and where the material would be bolted together. Also, indicate where you would place supporting columns. | 15 Points | _____ |
|----|--|-----------|-------|

2. With the materials provided to you and using a 1/2" scale, layout a floor system. The layout should be for a 12'-0" x 24'-0" building.

15 Points _____

A Layer-Complete no more than 20 Points

1. Research the properties of building green and write a report.
2. Research the products used in building green and list at least 12 products used for building green. Explain what each product is used for and what makes it acceptable by the green building council.

20 Points _____

20 Points _____

NAME: _____

WORKSHEET NO. 9

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 9-Wall Framing

Skills

- Calculate the number of studs needed to frame the exterior walls of a structure using 16" on center.
- Calculate the number of studs needed to frame the interior walls of a structure using 16" on center.
- Calculate the amount of material needed for the bottom, top and double top plates.
- Pass with 70% or better an 8 question, 9 minute timed test on exterior and interior wall framing.

C Layer-Complete no more than 30 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 246-247, Review Exercise 1-8 | 5 Points | _____ |
| 3. | Watch the first video on wall framing and take notes. | 5 Points | _____ |
| 4. | Watch the second video on floor framing and take notes. | 5 Points | _____ |
| 5. | On 3" x 5" cards or paper define the following terms and be able to define any of the terms: bottom plate, top plate, double top plate, regular stud, cripple, jack (trimmer) stud, king stud, sill, header, "T" partition, corner post, rough sill and blocking. | 10 Points | _____ |
| 6. | Make a poster showing a rough framed wall. Make sure you use all the terms listed in number 5. | 10 Points | |

B Layer-Complete no more than 15 Points

1. Using a 1/2" scale draw a rough framed wall with one window and one door opening. Show all the elements needed to frame a wall. The wall should be 16'-0" x 8'-0". You place the door and window in the wall but make sure you mark all dimensions.

15 Points _____

2. With the materials provided to you and using a 1/2" scale, layout a floor system. The layout should be for a 12'-0" x 24'-0" building.

15 Points _____

A Layer-Complete no more than 20 Points

1. Research the properties of a prefabricated housing system. Write a report on your findings. The report should be at least three paragraphs.

20 Points _____

2. If you were able to buy a home for yourself now, would you prefer to buy a newly built or an older home. Explain your answer.

20 Points _____

NAME: _____

WORKSHEET NO. 10

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 10-Common Rafters and Framing Square

Skills

- Demonstrate the use a framing square to find the unit line length of a rafter for a given slop.
- Determine the unit rise, unit run and unit line length of a rafter.
- Calculate the total rise, total run and total line length of a rafter.
- Determine the slope of an existing roof by means of the direct or indirect method.
- Pass with 70% or better an 8 question, 9 minute timed test on calculating line length on common rafters.

C Layer-Complete no more than 35 points

- | | | | |
|-----|--|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 261-263, Review Exercise 1-9 | 5 Points | _____ |
| 3. | Watch the first video on roof framing and take notes. | 5 Points | _____ |
| 4. | Watch the second video on roof framing and take notes. | 5 Points | _____ |
| 5. | On 3" x 5" cards or paper define the following terms and be able to define any of the terms: gable roof, hip roof, ridge board, common rafter, hip rafter, valley rafter, jack rafter, plate, span, run, rise, slope, framing square, plumb cut at ridge, line length of rafter, bird's mouth, overhang. | 15 Points | _____ |
| 6. | Make a poster showing a rough framed roof. Make sure you use all the terms listed in number 5. | 10 Points | _____ |

B Layer-Complete no more than 15 Points

1. Using a framing square, lay out and mark a rafter on a 2" x 6". The span of the building will be 10'-0" and the slope is 6/12. You will have a 12" overhang. Do not cut the rafter. When completed I will check for accuracy.
15 Points _____
2. Given the cut rafters numbers 1-10, determine the existing slope of each rafter. Mark your answer on a sheet of paper and explain how you came up with each answer.
15 Points _____

A Layer-Complete no more than 20 Points

1. Research the properties of a metal roof and compare the metal roof system to an asphalt shingle roof. Which system would you prefer and why?
20 Points _____
2. What is a thatched roof? Are there any problems that can be encountered with such a roof?
20 Points _____
3. Explain the different types of roof coverings, other than asphalt shingles, that are used throughout the United States roofing industry.
20 Points _____

NAME: _____

WORKSHEET NO. 11

DUE DATE: _____

MATH SKILLS WORKSHEET

Week 11-Interior and Exterior Wall and Roof Covering

Skills

- Determine the amount of materials needed to close in the exterior walls.
- Determine the amount of various types of siding needed to cover the exterior of a house.
- Determine the amount of drywall needed for the interior of a house.
- Determine the amount of materials needed to sheath a roof.
- Determine the amount of roofing material (felt paper, drip edge, shingles) needed for a roof.
- Pass with 70% or better a 10 question, 12 minute timed test on calculating materials.

C Layer-Complete no more than 35 points

- | | | | |
|-----|---|-----------|-------|
| *1. | Listen to lecture and take notes. | 5 Points | _____ |
| 2. | Textbook: <i>Mathematics for Carpentry and the Construction Trades</i>
Page 329, Review Exercise 1-6 | 5 Points | _____ |
| 3. | Textbook: <i>Practical Problems in Mathematics</i>
Page 156-157, Practical Problems 1-9 | 5 Points | _____ |
| 4. | Textbook: <i>Practical Problems in Mathematics</i>
Page 162-163, Practical Problems 1-7 | 5 Points | _____ |
| 5. | Textbook: <i>Practical Problems in Mathematics</i>
Page 168-169, Practical Problems 1-8 | 5 Points | _____ |
| 6. | Make a poster showing how you would sheath an exterior wall of a house. You must show the layout of the sheathing and nailing pattern | 10 Points | _____ |

7. Draw a poster showing how to install drywall to the interior of the house. You need to show the layout and nailing pattern. Also, include an explanation on how to estimate the sheets of drywall needed on a job. 10 Points _____
8. Draw a poster showing the correct layout of roof sheathing, felt paper and asphalt shingles. Include the nailing pattern and an explanation on how to estimate roofing materials 10 Points _____

B Layer-Complete no more than 15 Points

1. On the demonstration roof in the shop, layout the felt paper and roof shingles. When you have completed the work, I will check and grade your work. 20 Points _____
2. On the drywall demonstration walls, layout and screw in the drywall. When you have completed the work I will check and grade your work. You may then begin to mud and tape and it will be checked again for a grade. 20 Points _____

A Layer-Complete no more than 20 Points

1. What gives drywall its fire rating? Does the thickness of drywall have an affect on its fire rating? 20 Points _____
2. Should we have the right to build any structure we want and build that structure anywhere on the property we own? 20 Points _____

APPENDIX C
RUBRICS

Vocabulary Word Rubric

Assignment Type: Vocabulary Words
 Points Possible: 10 Points
 Grading Criteria: Oral Defense

Grading Scale: Instructor will take 5 cards from student's prepared cards. Student will receive 2 points for each word defined correctly. The definitions must be in the student's own words. Not memorized.

Textbook Assignment Rubric

Assignment Type: Textbook Math Problems
 Points Possible: 5 Points Each
 Grading Criteria: Oral Defense: Understanding the Computational Procedure

5 Points	Complete understanding of the problem and computational procedure.
4 Points	A minor omission of computational procedure.
3 Points	Partially correct procedure but with major fault.
2 Points	Total misunderstanding of computational procedure.
1 Point	Very inappropriate computational procedure or no attempt.

Lecture Note Rubric

Assignment Type: Attendance and Lecture Notes
 Points Possible: 5 Points Each
 Grading Criteria: Completeness of Notes Taken During Lecture

5 Points	Complete listing of main points and examples from lecture.
4 Points	Minor omission of a point or example from lecture.
3 Points	Several points or examples missing from lecture.
2 Points	Illegible and unorganized notes.
1 Point	In attendance but no notes taken during lecture.
0 Points	Not in attendance.

Poster, Bulletin Board or Chart Rubric

Criteria	4	3	2	1
Theme	Theme is very clear and evident and stands out from the rest of the information.	Theme is clear and evident but does stand out from the rest of the information.	Theme is somewhat unclear or obscure.	Main theme is unclear and not pronounced.
Accurate Information	All information is correct and no spelling and/or grammatical errors.	Information is correct. There is 1 spelling or grammatical error.	Omission of a minor detail in information. There are 2 to 3 spelling or grammatical errors.	Omission of a major detail. There are 4 spelling or grammatical errors.
Organization and Sequence	Sequence of information is easy to follow	Minor sequence of information error but still easy to follow.	Information is somewhat difficult to follow. Sequence is out of order.	Information is difficult to follow. Several sequence or information errors.
Attractiveness	Poster is exceptionally attractive in terms of design, layout and neatness.	Poster is attractive in terms of design, layout and neatness.	Poster is acceptably attractive though it may be a bit messy	Poster is acceptable but very messy.
Visual Elements	Printed and visual materials are easily read/seen from several feet away.	Printed and visual materials are somewhat difficult to read and be seen from at least 3 feet away.	Printed and visual materials cannot be read/seen unless within 3 feet of visual.	Printed and visual materials are not easily read/seen unless at a close distance.

Oral Presentation Rubric

Criteria	4	3	2	1
Content	Abundant material clearly related to topic. Main points are clear and evident.	Information is sufficient and relates to topic. Main points are somewhat unclear.	Some information is unrelated to main topic and unclear.	A great deal of information is not connected to the main topic.
Organization	Well organized and information flows together well. Examples are clear and appropriate.	Most information presented in a logical sequence. Organized but a better transition from idea to idea.	Loosely connected. Lacks a smooth transition. Flow is choppy.	Presentation is choppy and disjointed. Does not flow.
Speaking Skills	Clear articulation. Proper volume. Enthusiastic and confident.	Clear articulation but not polished.	Some mumbling. Little or no expression.	Inaudible or too loud. Too fast or too slow. Shows disinterest and uses monotone.
Material of Visual Aids	Excellent use of visual aids. Supports information in presentation.	Good use of visual aids. Not well connected to content.	Choppy use of visual aids. Lacks a smooth transition from one medium to another.	Little use of visual aids. Relied too heavily on oral presentation.
Length of Presentation	Within one minutes of allotted time. +/-	Within two minutes of allotted time. +/-	Within three minutes of allotted time. +/-	Within four minutes of allotted time. +/-

Written Report Rubric

Criteria	4	3	2	1
Organization	Question is clearly stated and developed. Conclusion is clear. Flows together well with good transition. Well organized.	Most information is presented in a logical sequence. Good organization. Transition is not fluent.	Ideas are loosely connected. Lacks clear transition. Flow and organization is choppy.	Organization is choppy and disjointed. Does not flow well. No logical order of writing.
Ideas and Content	Paper is focused clear and specific. Question was answered. Points are clearly made and evidence supports the conclusion.	Sufficient information that relates to the topic. Several good points made.	A great amount of information given that is not clearly related to the topic.	Topic not clear. Information given does not support topic questions.
Sentence and Paragraph Fluency	Paragraphs and sentences for fluent.	Some paragraphs and sentences are choppy	Some paragraphs and sentences are choppy and awkward. Many sentences begin the same way.	Paper needs work. Sentence patterns are repetitive.
Mechanics	No spelling, grammatical or punctuation errors.	A spelling, grammatical or punctuation error evident.	There are 2-3 spelling, grammatical or punctuation errors.	The are 4 or more spelling, grammatical or punctuation errors.
Appearance of Paper	Typed: Correct setup 1" margins all sides Written: Legible and written in ink.	Typed: Minor setup error. Written: Neat corrections.	Typed: Major setup error. Written: Disregard to paragraph and sentence structure.	Typed: Messy and major setup errors. Written: Very messy and illegible.

Word Problem Solving Rubric

Assignment Type: Solving a word problem
 Points Possible: 5, 10, or 20 points depending on difficulty of problem
 Grading Criteria: Strategy used to solve problem

5 Points	A plan that leads to a correct solution with no arithmetic errors.
4 Points	Substantially correct procedure with minor omission or procedural error.
3 Points	Partially correct procedure but contains a major error.
2 Points	Substantially incorrect procedure and contains a major error.
1 Point	Little or No attempt.

10 Point Scale

9-10 Points
 8 Points
 7 Points
 6 Points
 1-5 Points

20 Point Scale

18-20 Points
 16-17 Points
 14-15 Points
 12-13 Points
 1-11 Points

Shop or Construction Project Rubric

Criteria	4	3	2	1
Problem Solving	Sets up a plan that leads to a correct solution with no errors.	Develops a substantially correct procedure with minor omission or procedural error.	Develops a partially correct procedure but with 1 or more major errors.	Very little or no attempt at setting up a procedural plan for solving the problem.
Quality of Work	Provides work of the highest quality. Neat and precise.	Provides work of high quality. Minor precision error.	Provides work that occasionally needs to be checked/redone to ensure quality.	Provides poor work that constantly needs to be checked and redone to ensure quality.
Application of Math Principles to Construct Project	Student uses mathematical principles efficiently while justifying the solution.	Student needs assistance in using and justifying mathematical principles to construct project.	Student is unable to apply mathematical principles to construct project.	Student misuses mathematical principles to a construct project.
Project Completion	Student completes all-important components of the task.	Student completes most important components of the task.	Student completes some important components of the task.	Student shows minimal understanding or makes no attempt at project completion.
Time-Management and Shop Clean Up	Routinely uses time well throughout the assignment to ensure project is completed on time. Work area is always cleaned up before leaving and tools put away.	Usually uses time well throughout the assignment to ensure project is completed on time. Occasionally forgets to clean work area and put tools away.	Tends to procrastinate in completing project. Sometimes forgets to clean work area and put tools away.	Student always procrastinates in completing project and turns in work late. Constantly leaves work area messy and does not put tools away.

Drawing and Floor Plan Rubric

Criteria	4	3	2	1
Scaling	Correct scale used with no errors in scaled drawing.	Correct scale used with minor error in scaled drawing.	Correct scale used with a major error in scaled drawing.	Major errors in scaling in drawing.
Dimensions	All extension lines and dimensions are properly located on drawing.	All extension lines and dimensions are properly located but with minor error(s).	Extension lines and dimensions are improperly located on drawing.	Major errors in placement of extension lines and dimensions on drawing.
Math Application	Complete understanding of the mathematical task as applied to this problem.	Good understanding of the mathematical task as applied to this problem.	Only fragmented understanding of the mathematical task as applied to this problem.	No understanding of the mathematical task as applied to this problem.
Neatness and Accuracy	Drawing is neat, clean, and exceptionally attractive in terms of design and layout.	Drawing is neat, clean, and attractive in terms of design and layout.	Drawing is somewhat neat and clean. Drawing is acceptably attractive though a bit messy.	Drawing is not neat and clean. It is distractingly messy or very poorly designed. Very unpresentable.
Problem Solving	A plan was used that lead to a correct solution with no arithmetic errors.	Substantially correct procedure with minor omission or procedural error.	Partially correct procedure but with major errors.	Totally inappropriate plan.

Unit Worksheet Scale

Unit worksheets for all layers, layer C, B and A, will consist of a variety of activities that will vary in point value. Therefore, each unit worksheet will yield a different point value. Since these values are not the same, the final grade for each unit will be based on a percentage.

Unit Worksheet Percentage Rubric

Assignment Type: Unit Worksheet
 Points Possible: Point will vary according to the number of activities in each unit.
 Grading Criteria: Percentages

90-100%	A
80-89%	B
70-79%	C
60-69%	D
0-59%	F

Individual Unit Worksheet Grading Rubric

Assignment Type: Unit Worksheet Grading Rubric
 Points Possible: Points will vary according to the number of activities in each unit.
 Grading Criteria: Percentages

Worksheet Number	Points	Grading Scale (Points)	
1	100	90-100	A
		80-89	B
		70-79	C
		60-69	D

Worksheet Number	Points	Grading Scale (Points)	
2	110	99-110	A
		88-98	B
		77-87	C
		66-76	D
3	110	99-110	A
		88-98	B
		77-87	C
		66-76	D
4	95	86-95	A
		76-85	B
		67-75	C
		57-66	D
5	105	95-105	A
		85-95	B
		75-84	C
		63-74	D
6	100	90-100	A
		80-89	B
		70-79	C
		60-69	D
7.	65	59-65	A
		52-58	B
		46-51	C
		39-45	D
8	60	54-60	A
		48-53	B
		42-47	C
		36-41	D
9	70	63-70	A
		54-62	B
		49-53	C
		42-48	D
10	75	68-75	A
		60-67	B
		53-59	C
		45-52	D

Worksheet Number	Points	Grading Scale (Points)	
11	75	68-75	A
		60-67	B
		53-59	C
		45-52	D

Unit Test Scale

Each unit will conclude with a unit test. Since each unit test will consist of a different number of questions, the score earned on each test will be based on a percentage score. Therefore, the following rubric will be used to determine a unit test grade.

Unit Test Rubric

Assignment Type:	Unit Test	
Points Possible:	Will vary according to number of questions on each test.	
Grading Criteria:	Percentages	
	90-100%	A
	80-89%	B
	70-79%	C
	60-69%	D
	0-59%	F

APPENDIX D

PRE-TEST, UNIT TESTS 1-11 AND POST-TEST

NAME: _____

DATE: _____

MATH PRE-TEST

Time – 30 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You must use commas in all your answers.

1.
$$\begin{array}{r} 84 \\ +13 \\ \hline \end{array}$$
 1. _____
2.
$$\sqrt[7]{3521}$$
 2. _____
3. $82 \frac{1}{2} - 23 \frac{3}{4}$ 3. _____
4. $9 \frac{1}{2} \times 6 \frac{1}{4}$ 4. _____
5. $168 \frac{3}{4} \div 8 \frac{1}{2}$ 5. _____
6. $29/42 + 12/21$ 6. _____
7. $8 \frac{3}{4} \times 12.5$ 7. _____
8.
$$\begin{array}{r} 148 \\ -79 \\ \hline \end{array}$$
 8. _____
9.
$$\begin{array}{r} 9070 \\ \times 707 \\ \hline \end{array}$$
 9. _____
10. $224 \div 8.75$ 10. _____
11. $1/1000 + 3.616$ 11. _____

12. $13.9 - 67.45$ 12. _____
13. What is 5% of $\frac{3}{4}$? 13. _____
14. There are 86 workers in a plant and 31 are male.
- a. What percent of the workers are female? 14a. _____
- b. What percent of the workers are male? 14b. _____
15. A candy package reads that it contains 33% more candy. If the original package weighed 16 oz., how much more does the new package weigh? 15. _____
16. There is a sale of 30% off the original price of \$38.50.
- a. What is your discount? 16a. _____
- b. How much will you pay for the item? 16b. _____
17. $\sqrt{55}$ 17. _____
18. 18^2 18. _____
19. $\sqrt{84}$ 19. _____
20. Altitude Base Hypotenuse
 9.82 14.16 _____ 20. _____
21. Find the area of a rectangle 28 feet wide and 32 feet long. 21. _____
22. Find the perimeter of a square that is 144 inches. 22. _____
23. A window is $3' - 6'' \times 4' - 2''$ what is the area of this window? 23. _____

24. A rectangular table is to be covered with oak veneer costing \$2.89 per square foot. If the table is 3 feet by 6 feet, what is the cost of the oak veneer? 24. _____
25. Calculate the number of cubic yards of concrete needed for the footing of a house measuring 24'-0" x 42'-0". The footing is to be 16" wide and 8" high. 25. _____
26. Calculate the number of cubic yards of concrete needed for the foundation wall for the house in problem 25. The foundation wall is to be 8" thick and 7'-0" high. Use the exact method for figuring the amount of concrete needed. 26. _____
27. If the concrete costs \$75 per cubic yard, find the cost of the concrete needed for the footing in problem 26. 27. _____
28. Calculate the number of cubic yards of concrete needed for the basement floor in the 24'-0" x 44'-0" house in problem 1 by using the exact method. The slab is 4" thick. 28. _____
29. If the perimeter of a shed is 12 feet by 16 feet, how many joists are needed for the floor system and what length joists should you purchase? 29. _____
30. Calculate for question 29 the number of header joists and how long the header joists need to be. 30. _____
31. How many sheets of 4' x 8' sheathing do you need for a subfloor which is 14 feet x 44 feet? 31. _____

32. How many studs will you need to frame a 36'-0" x 8'-1 1/2" wall with corner posts at each end using 16" on center. There are no wall openings? 32. _____
33. If a house has a perimeter of 24'-0" x 48'-0" how many and what size 2" x 4" do you need for your plates? 33. _____
34. How many studs will you need to frame a wall 53'-6" x 8'-1 1/2" wall with corner posts at each end using 24" on center. There are no wall openings? 33. _____

Calculate the rafter length for each of the following unit rises and runs. Express answers in feet and inches, correct to the nearest 1/16 inch.

- | | <u>Unit Rise</u> | <u>Run</u> | |
|-----|------------------|--------------|-----------|
| 35. | 6 | 14 ft. 8 in. | 35. _____ |
| 36. | 8 | 18 ft. 6 in | 36. _____ |

The total rise and total run (exclusive of overhang) are given for several roofs. In each case, calculate the unit rise, correct to the nearest 1/8 inch.

- | | <u>Rise</u> | <u>Run</u> | |
|-----|-------------|------------|-----------|
| 37. | 6 ft. 6 in. | 14 ft. | 37. _____ |
| 38. | 14 ft. | 14 ft. | 38. _____ |
39. How many sheets of subflooring will you need for a floor system that is 12'-0" by 32'-0"? 39. _____
40. How many sheets of 4' x 8' sheetrock will you need to cover for four walls that measure 12'-0" by 8'-0" each and the ceiling? 40. _____

NAME: _____

DATE: _____

MATH TEST

Test 1 – Whole Numbers

Time – 6 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.

- | | | | | | | | |
|-----|--|-----|---|-----|---|-----|-------|
| 1. | $\begin{array}{r} 84 \\ +13 \\ \hline \end{array}$ | 8. | $\begin{array}{r} 148 \\ -79 \\ \hline \end{array}$ | 15. | $\begin{array}{r} 9070 \\ \times 707 \\ \hline \end{array}$ | 1. | _____ |
| | | | | | | 2. | _____ |
| | | | | | | 3. | _____ |
| 2. | $\begin{array}{r} 87 \\ \times 9 \\ \hline \end{array}$ | 9. | $\begin{array}{r} 473 \\ -384 \\ \hline \end{array}$ | 16. | $7 \overline{)3521}$ | 4. | _____ |
| | | | | | | 5. | _____ |
| | | | | | | 6. | _____ |
| 3. | $\begin{array}{r} 65 \\ +54 \\ \hline \end{array}$ | 10. | $\begin{array}{r} 6793 \\ -794 \\ \hline \end{array}$ | 17. | $9 \overline{)288}$ | 7. | _____ |
| | | | | | | 8. | _____ |
| | | | | | | 9. | _____ |
| 4. | $\begin{array}{r} 956 \\ +487 \\ \hline \end{array}$ | 11. | $\begin{array}{r} 54 \\ \times 4 \\ \hline \end{array}$ | 18. | $90 \overline{)1620}$ | 10. | _____ |
| | | | | | | 11. | _____ |
| | | | | | | 12. | _____ |
| 5. | $\begin{array}{r} 43 \\ 457 \\ 9 \\ +5482 \\ \hline \end{array}$ | 12. | $\begin{array}{r} 67 \\ \times 59 \\ \hline \end{array}$ | 19. | $74 \overline{)7384}$ | 13. | _____ |
| | | | | | | 14. | _____ |
| | | | | | | 15. | _____ |
| 6. | $\begin{array}{r} 85 \\ -44 \\ \hline \end{array}$ | 13. | $\begin{array}{r} 608 \\ \times 73 \\ \hline \end{array}$ | 20. | $783 \overline{)142506}$ | | |
| 16. | _____ | 18. | _____ | 20. | _____ | | |
| 17. | _____ | 19. | _____ | | | | |

NAME: _____

DATE: _____

MATH TEST

Test 2 – Fractions

Time – 10 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.

1. $82 \frac{1}{2} - 23 \frac{3}{4} =$ _____

2. $9 \frac{1}{2} \times 6 \frac{1}{4} =$ _____

3. $8 \frac{3}{4} \times 12.5 =$ _____

4. $36 \frac{1}{4} - 19 \frac{5}{8} =$ _____

5. $\frac{1}{4} + \frac{1}{16} =$ _____

6. $\frac{29}{42} + \frac{12}{21} =$ _____

7. $68 \div 8 \frac{1}{2} =$ _____

8. $\frac{1}{12} \div \frac{1}{4} =$ _____

9. $\frac{29}{72} - \frac{5}{36} =$ _____

10. $5 \div \frac{1}{4} =$ _____

11. $\frac{1}{2} \times \frac{1}{4} =$ _____

12. $6 \frac{6}{8} - 4 \frac{1}{2} =$ _____

13. $\frac{1}{5} \times \frac{1}{12} =$ _____

14. $\frac{1}{2} \times \frac{3}{8} =$ _____

15. $\frac{1}{3} \div \frac{1}{6} =$ _____

NAME: _____

DATE: _____

MATH TEST

Test 3 – Decimal Fractions

Time – 12 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers. Round all decimal answers to 4 places.

- | | | | | | | | |
|-----|------------------------------|---|-------|-----|--------------------------|---|-------|
| 1. | $9 \div 12$ | = | _____ | 16. | $67.45 - 13.9$ | = | _____ |
| 2. | $8 \frac{3}{4} \times 12.5$ | = | _____ | 17. | $74 + 11.3$ | = | _____ |
| 3. | $63 \div 7.5$ | = | _____ | 18. | $9 \div .3$ | = | _____ |
| 4. | $224 \div 8.75$ | = | _____ | 19. | $.017 + .504$ | = | _____ |
| 5. | $1.57 - .028$ | = | _____ | 20. | $.671 - .659$ | = | _____ |
| 6. | $19.75 \times 5 \frac{1}{2}$ | = | _____ | 21. | 83×2.9 | = | _____ |
| 7. | $1.78 \div .178$ | = | _____ | 22. | $81.75 + 67.033$ | = | _____ |
| 8. | 1.09×2.4 | = | _____ | 23. | $\frac{1}{1000} + 3.616$ | = | _____ |
| 9. | $18 \div 4$ | = | _____ | 24. | $7.3 - .017$ | = | _____ |
| 10. | $1.78 - \frac{3}{4}$ | = | _____ | 25. | $87 - 63.75$ | = | _____ |
| 11. | $78 \div 24$ | = | _____ | | | | |
| 12. | $3.36 \div 2.4$ | = | _____ | | | | |
| 13. | $57.1 - 4.31$ | = | _____ | | | | |
| 14. | 18.3×13.67 | = | _____ | | | | |
| 15. | 1.8×3.5 | = | _____ | | | | |

NAME: _____

DATE: _____

MATH TEST

Test 4 – Percent and Percentages

Time – 15 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You must use commas in all your answers.

1. 8% of 11
1. _____
2. There are 21 pencils and 9 pens in a box:
 - a. What is the percentage of pencils in the box?
2a. _____
 - b. What is the percentage of pens in the box?
2b. _____
3. A pattern calls for 5 yards of material plus 5% more to match print. How much material will you need to buy?
3. _____
4. The material used for the above problem normally sells for \$4.98 a yard. If the material needed for the above problem is purchased during a 20% off the original price sale, how much will the material cost?
4. _____
5. What is 4% of $\frac{1}{4}$?
5. _____
6. If, on average, two out of every 18 cars are red, how many red cars would you count in a parking lot of 164?
6. _____

7. A team won 98 games and lost 24.
- a. What is their winning percentage? 7a. _____
- b. What is their losing percentage? 7b. _____
8. There 97 workers in a plant and 48 are female.
- a. What percent of the workers are female? 8a. _____
- b. What percent of the workers are male? 8b. _____
9. A package reads that it contains 25% more ingredients. If the original package weighed 12 oz., how much more does the new package weigh? 9. _____

NAME: _____

DATE: _____

MATH TEST

Test 5 – Angles, Triangles and Pythagorean Theorem

Time – 15 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You must use commas in all your answers.

Using the square and square root keys on a calculator, determine the following answers, rounding to three decimal places where necessary

1. 9.35^2 1. _____

2. 16^2 2. _____

3. 38^2 3. _____

4. 0.673^2 4. _____

5. $\sqrt{25}$ 5. _____

6. $\sqrt{6.39}$ 6. _____

7. $\sqrt{15.7}$ 7. _____

8. $\sqrt{4}$ 8. _____

Complete the table for right triangle $\triangle ABC$, $\angle C$ is the right angle.

	Side A-Altitude	Side B-Base	Side C-Hypotenuse	
9.	_____	14.16	19.24	9. _____
10.	9.28	11.36	_____	10. _____
11.	18.35	_____	26.33	11. _____
12.	6.23	8.35	_____	12. _____
13.	A rectangular foundation measures $30' - 0'' \times 45' - 0''$. What should the diagonals measure, to the nearest $1/4''$?			13. _____
14.	A square deck is $10' - 0''$ on a side. What is the length of the diagonal of the deck?			14. _____
15.	The diagonal of a rectangular foundation measures $51' - 1 \frac{1}{4}''$. If the length of the foundation is $44' - 0''$, what is the width to the nearest $1/4''$?			15. _____

NAME: _____

DATE: _____

MATH TEST

Test 6 – Area and Perimeter

Time – 15 minutes

Directions: In the space provided to the right, write all your answers to the math questions in the space provided. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.

1. Find the perimeter of a rectangle that is 9 inches long and 4 inches wide.
1. _____
2. Find the area of the rectangle in problem 1.
2. _____
3. Find the area of a square which is 5 feet on a side.
3. _____
4. Find the perimeter of the square in problem 3.
4. _____
5. A square table is to be covered with plastic laminate costing \$1.87 per square foot. If the perimeter of the table is 12 feet, what is the cost of the laminate to cover it?
5. _____
6. A door is 6'-8" by 2'-6", what is the area, in square inches, of the door?
6. _____

Complete the table for the rectangle describes.

	Length	Width	Perimeter	Area	
7.	12''	_____	30''	_____	7.Width_____
					Area_____
8.	18'	_____	_____	192' ²	8.Width_____
					Perimeter_____
9.	16'-4''	9'-7''	_____	_____	9.Perimeter_____
					Area_____
10.	_____	28'	114'	_____	10.Length_____
					Area_____
11.	Floor tiles 1' x 1' are to be installed on a kitchen floor measuring 10'-10'' x 12'-6''. How many tiles are needed? Add six tiles for waster and proper fitting.				11._____

NAME: _____

DATE: _____

MATH TEST

Test 7 – Foundations and Slabs

Time – 20 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You must use commas in all your answers.

1. Calculate the number of cubic yards of concrete needed for the footing of a house measuring 26'-0" x 34'-0". The footing is to be 16" wide and 8" high.
1. _____

2. Calculate the number of cubic yards of concrete needed for the foundation wall for the house in problem 1. The foundation wall is to be 8" thick and 7'-0" high. Use the exact method for figuring the amount of concrete needed.
2. _____

3. If the concrete costs \$65 per cubic yard, find the cost of the concrete needed for the footing in problem 1.
3. _____

4. If the concrete costs \$65 per cubic yard, find the cost of the concrete needed for the foundation wall in problem 1.
4. _____

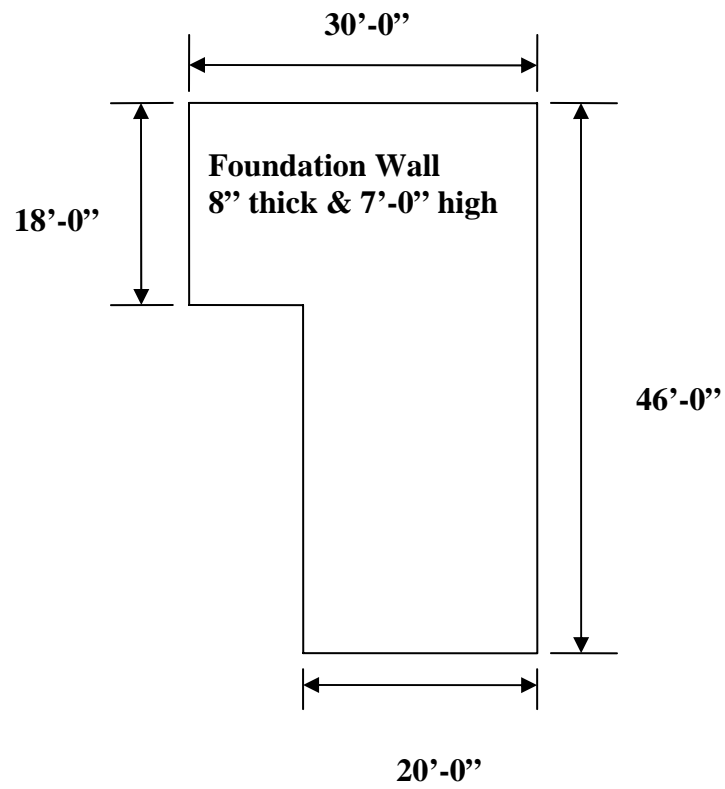
5. Calculate the number of cubic yards of concrete needed for the basement floor in the 26'-0" x 34'-0" house in problem 1 by using the exact method. The slab is 4" thick.
5. _____

6. To calculate the amount of concrete needed for any rectangle solid (slab, footing, foundation), the three step rule is:

1.

2.

3.



The dimensions of the house are noted on the previous page. Including wall thickness and height. Assume the footings to be 8 inches high and twice the thickness of the foundation wall; the basement floor is to be 4 inches thick. For the foundation dimensions given, calculate the amount of concrete needed for the footing, the foundation walls, and the floor. Use the exact method for calculating cubic yards for each. Include the total cost figure.

7. Footing _____

8. Foundation Wall _____

9. Basement Floor _____

10. If the concrete costs \$75 per cubic yard, find the total cost for the footings, foundation walls, and basement floor.

10. Cost _____

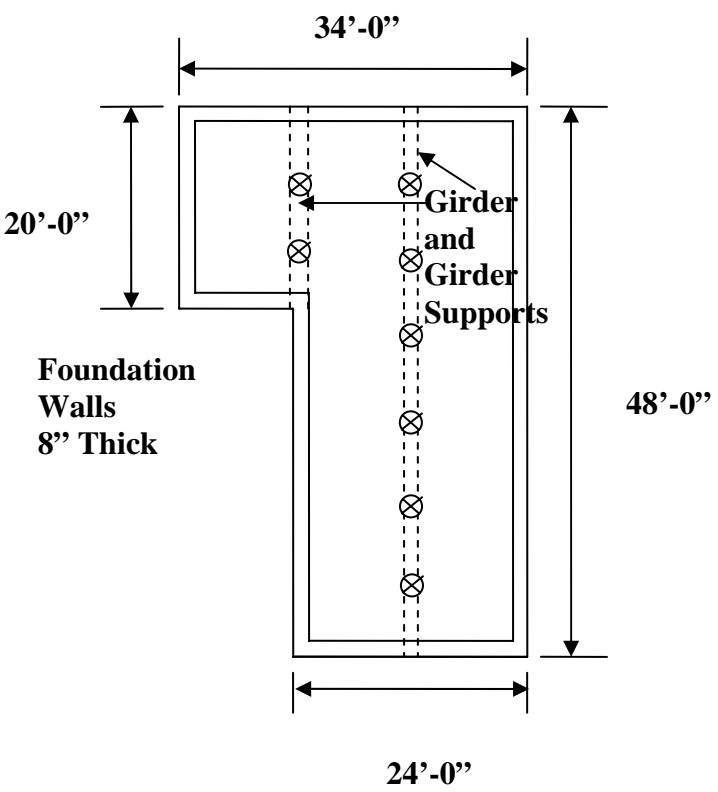
NAME: _____

DATE: _____

MATH TEST

Test 8 – Girders, Sill Plates, Bridging, Floor Joists and Floor Covering
Time – 20 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.



In the foundation plan, you will find an outline of a foundation giving all outside dimensions. Girder position is shown by a dashed line and girder support position is shown by a circle with an X. For the foundation shown, determine the following material requirements.

1. The materials needed for an economical built-up girder design
assumer three laminated beams for each girder.
1. _____

2. The number of pieces and their lengths for floor joists
for 2 x 8 sill plates.
2. _____

3. The number of 2" x 10" and lengths for floor joists and
floor-joist headers placed 16" on center.
3. _____

4. The total number of feet of 1 x 3 bridging material
4. _____

5. The number of 4' x 8' sheets of sheathing needed
for subflooring.
5. _____

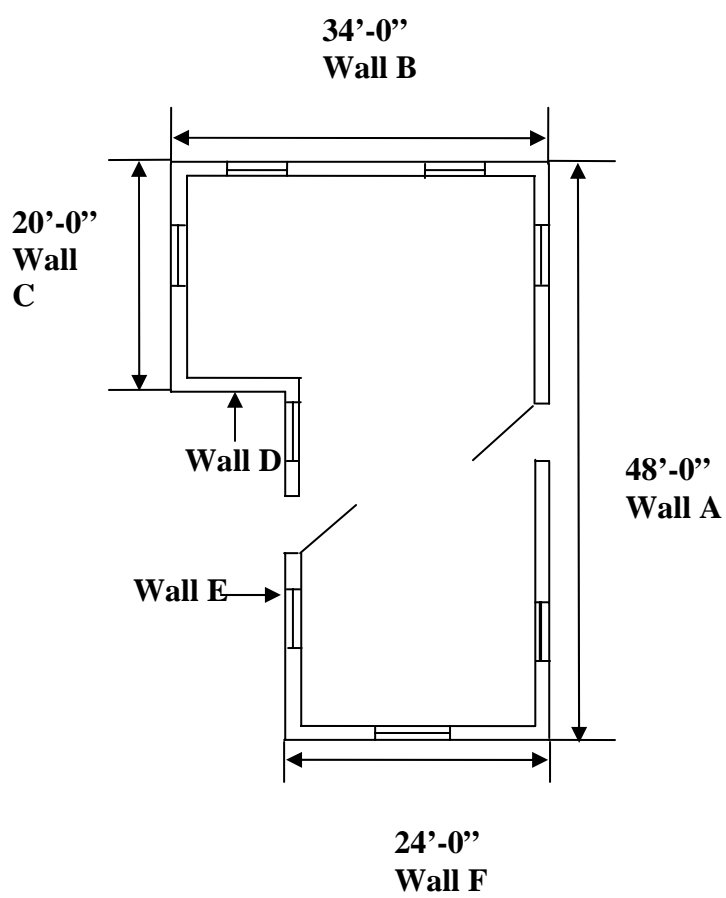
NAME: _____

DATE: _____

MATH TEST

Test 9 – Wall Framing
Time – 16 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.



Windows: All windows will measure 3'-0" x 4'-0".
Door: Door measurement is 3'-6" x 6'-8".
All headers will be built using 2 x 8 materials.
Corner posts will be built in walls A, C and E.

Above you will find a floor plan. From the floor plan, determine the following material requirements.

1. Determine the number of studs needed to frame Wall A. Use 16" on center. Assume there will be corner posts at each end of the wall. Make all adjustment for wall openings.
1. _____

2. Answer question no. 1 if the studs are placed 24" on center.
2. _____

3. Determine the materials and length of materials needed for the bottom, top and double top plates.
3. _____

4. Determine the number of studs needed to frame Wall B. Use 16" on center. Make all adjustments for wall openings.
4. _____

5. Determine the number of studs needed to frame Wall C. Use 16" on center. Make all adjustments for wall openings.
5. _____

6. Determine the number of studs needed to frame Wall D. Use 16" on center. Make all adjustments for wall openings.
6. _____

7. Determine the number of studs needed to frame Wall E.
Use 16" on center. Make all adjustments for wall
openings.

7. _____

8. Determine the number of studs needed to frame Wall F.
Use 16" on center. Make all adjustments for wall
openings.

8. _____

NAME: _____

DATE: _____

MATH TEST

Test 10 – Common Rafters and Framing Square

Time – 20 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You must use commas in all your answers.

Listed below are various values for unit rise. For each, calculate the unit line length value correct to three decimal places.

	<u>Unit Rise</u>	
1.	4	1. _____
2.	5 1/2	2. _____
3.	8	3. _____
4.	10	4. _____

Calculate the rafter length for each of the following unit rises and runs. Express answers in feet and inches, correct to the nearest 1/16 inch.

	<u>Unit Rise</u>	<u>Run</u>	
5.	4	14 ft. 8 in.	5. _____
6.	5	10 ft. 6 1/2 in.	6. _____
7.	7 1/2	14 ft. 8 in.	7. _____

The total rise and total run (exclusive of overhang) are given for several roofs. In each case, calculate the unit rise, correct to the nearest 1/8 inch.

	<u>Rise</u>	<u>Run</u>	
8.	6 ft. 6 in.	13 ft.	8. _____
9.	14 ft.	16 ft., 10 in,	9. _____
10.	16 ft.	16 ft.	10. _____

NAME: _____

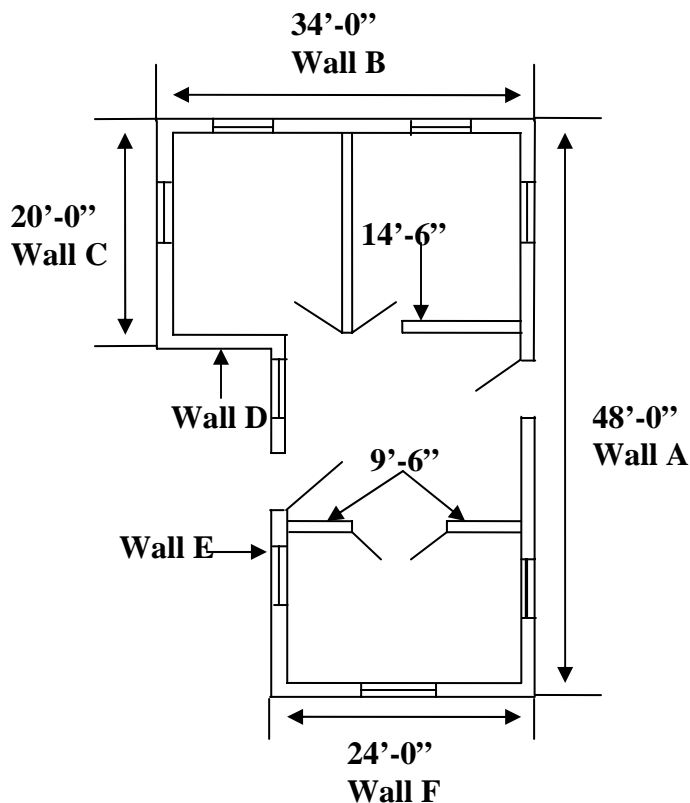
DATE: _____

MATH TEST

Test11 – Interior and Exterior Wall and Roof Covering

Time – 30 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. Use commas in all your answers.



Windows: All windows will measure 3'-0" x 4'-0".

Door: Exterior door measurement is 3'-6" x 6'-8".

All headers will be built using 2 x 6 materials.

Corner posts will be built in walls A, C and E.

Gable roof: 5/12 slope and a 12" lookout at each end of gable roof with an overhang of 1'-0".

Above you will find a floor plan. From the floor plan, determine the following material requirements.

1. Determine the number of sheets of sheathing needed to close in the exterior walls. 1. _____

2. Determine the number of sheets of 4 x 8 sheetrock for all ceilings. 2. _____

3. Determine the number of sheets of 4 x 8 sheetrock for the interior walls. 3. _____

4. Determine the number of sheets of roof sheathing. 4. _____

5. Determine the number of squares of shingles.(ranch style house). 5. _____

6. Determine the number of sheets of subflooring. 6. _____

7. Assume the house has a hip roof and a slope of 6/12, Determine the number of sheets of sheathing needed to close in the exterior walls. 7. _____
8. Using the floor plan above determine the number of 10 foot lengths of metal drip ledge to be applied. Assume the drip edge is to be applied to all roof edges along the lookouts as well as the eaves. 8. _____
9. Using the floor plan above determine the number of square feet of siding deducting openings for a gable roof. 9. _____

NAME: _____

DATE: _____

MATH POST-TEST

Time – 30 minutes

Directions: In the space provided to the right, write all your answers to the math questions. Please write legibly. If the answer can be taken for one of two numbers, the answer will be marked incorrect. You use commas in all your answers.

1.
$$\begin{array}{r} 84 \\ +13 \\ \hline \end{array}$$
 1. _____

2.
$$7\overline{)3521}$$
 2. _____

3. $82\frac{1}{2} - 23\frac{3}{4}$ 3. _____

4. $9\frac{1}{2} \times 6\frac{1}{4}$ 4. _____

5. $168\frac{3}{4} \div 8\frac{1}{2}$ 5. _____

6. $29/42 + 12/21$ 6. _____

7. $8\frac{3}{4} \times 12.5$ 7. _____

8.
$$\begin{array}{r} 148 \\ -79 \\ \hline \end{array}$$
 8. _____

9.
$$\begin{array}{r} 9070 \\ \times 707 \\ \hline \end{array}$$
 9. _____

10. $224 \div 8.75$ 10. _____

11. $1/1000 + 3.616$ 11. _____

12. $13.9 - 67.45$ 12. _____
13. What is 5% of $\frac{3}{4}$? 13. _____
14. There are 86 workers in a plant and 31 are male.
- a. What percent of the workers are female? 14a. _____
- b. What percent of the workers are male? 14b. _____
15. A candy package reads that it contains 33% more candy. If the original package weighed 16 oz., how much more does the new package weigh? 15. _____
16. There is a sale of 30% off the original price of \$38.50.
- a. What is your discount? 16a. _____
- b. How much will you pay for the item? 16b. _____
17. $\sqrt{55}$ 17. _____
18. 18^2 18. _____
19. $\sqrt{84}$ 19. _____
20. Altitude Base Hypotenuse
 9.82 14.16 _____ 20. _____
21. Find the area of a rectangle 28 feet wide and 32 feet long. 21. _____
22. Find the perimeter of a square that is 144 inches. 22. _____
23. A window is 3'-6" x 4'-2" what is the area of this window? 23. _____

24. A rectangular table is to be covered with oak veneer costing \$2.89 per square foot. If the table is 3 feet by 6 feet, what is the cost of the oak veneer? 24. _____
25. Calculate the number of cubic yards of concrete needed for the footing of a house measuring 24'-0" x 42'-0". The footing is to be 16" wide and 8" high. 25. _____
26. Calculate the number of cubic yards of concrete needed for the foundation wall for the house in problem 25. The foundation wall is to be 8" thick and 7'-0" high. Use the exact method for figuring the amount of concrete needed. 26. _____
27. If the concrete costs \$75 per cubic yard, find the cost of the concrete needed for the footing in problem 26. 27. _____
28. Calculate the number of cubic yards of concrete needed for the basement floor in the 24'-0" x 44'-0" house in problem 1 by using the exact method. The slab is 4" thick. 28. _____
29. If the perimeter of a shed is 12 feet by 16 feet, how many joists are needed for the floor system and what length joists should you purchase? 29. _____
30. Calculate for question 29 the number of header joists and how long the header joists need to be. 30. _____
31. How many sheets of 4' x 8' sheathing do you need for a subfloor which is 14 feet x 44 feet? 31. _____

32. How many studs will you need to frame a 36'-0" x 8'-1 1/2" wall with corner posts at each end using 16" on center. There are no wall openings? 32. _____
33. If a house has a perimeter of 24'-0" x 48'-0" how many and what size 2" x 4" do you need for your plates? 33. _____
34. How many studs will you need to frame a wall 53'-6" x 8'-1 1/2" wall with corner posts at each end using 24" on center. There are no wall openings? 33. _____

Calculate the rafter length for each of the following unit rises and runs. Express answers in feet and inches, correct to the nearest 1/16 inch.

- | | <u>Unit Rise</u> | <u>Run</u> | |
|-----|------------------|--------------|-----------|
| 35. | 6 | 14 ft. 8 in. | 35. _____ |
| 36. | 8 | 18 ft. 6 in | 36. _____ |

The total rise and total run (exclusive of overhang) are given for several roofs. In each case, calculate the unit rise, correct to the nearest 1/8 inch.

- | | <u>Rise</u> | <u>Run</u> | |
|-----|-------------|------------|-----------|
| 37. | 6 ft. 6 in. | 14 ft. | 37. _____ |
| 38. | 14 ft. | 14 ft. | 38. _____ |
39. How many sheets of subflooring will you need for a floor system that is 12'-0" by 32'-0"? 39. _____

40. How many sheets of 4' x 8' sheetrock will you need to cover for four walls that measure 12'-0" by 8'-0" each the ceiling? 40. _____

APPENDIX E
COURSE EVALUATION

CONSTRUCTION TRADES PROGRAM

Math Curriculum Evaluation

Directions: Answer the following questions as it pertains to the math curriculum taught in this program.

- Strongly Agree - 5
 Agree - 4
 Neither Agree or Disagree - 3
 Disagree - 2
 Strongly Disagree - 1

- | | | | | | | |
|----|---|---|---|---|---|---|
| 1. | I will be able to apply the information or skills provided in this math class. | 5 | 4 | 3 | 2 | 1 |
| 2. | The resource textbooks used in this class helped reinforce my learning. | 5 | 4 | 3 | 2 | 1 |
| 3. | The instructor was well organized and prepared. | 5 | 4 | 3 | 2 | 1 |
| 4. | The instructor created an appropriate learning climate. | 5 | 4 | 3 | 2 | 1 |
| 5. | The instructor provided clear directions during each activity. | 5 | 4 | 3 | 2 | 1 |
| 6. | The instructor had a pleasant style and delivery which was conducive to learning. | 5 | 4 | 3 | 2 | 1 |
| 7. | The pacing of the class was just right for learning. | 5 | 4 | 3 | 2 | 1 |
| 8. | The instructor had a strong command of the subject matter. | 5 | 4 | 3 | 2 | 1 |
| 9. | How would you rate the time devoted to the subject matter? | | | | | |
| | <input type="checkbox"/> Just Right | | | | | |
| | <input type="checkbox"/> Too Short | | | | | |
| | <input type="checkbox"/> Too Long | | | | | |

10. What was your overall reaction to the material taught?
- Excellent
 - Better than expected
 - Satisfactory
 - Below average
11. Did you have enough skill practice time?
- Yes
 - Uncertain
 - No
12. Which term below do you feel best describes the teaching level of this program?
- Very difficult
 - Difficult
 - Suitable
 - Too easy
13. To what degree did you apply yourself in this class?
- To a great degree
 - To some degree
 - To a very little degree
 - To no degree
14. Was the math course work appropriate for the construction trades class?
- Yes
 - Uncertain
 - No
15. Were you motivated to learn this material?
- Yes
 - Uncertain
 - No
16. How much effort did you put forth in this class?

- A lot of effort
 - Some effort
 - Very little effort
17. To what degree did the instructor hold high standards for your work?
- To a great degree
 - To some degree
 - To a very little degree
 - To no degree
18. Rate how well your learning experience in this class strengthened your math skills.
- To a high degree
 - To some degree
 - To a very little degree
 - To no degree
19. What did you like best about this class?
20. What did you like least about this class?
23. If you could change anything in this class, what would you like to see changed?
24. If you have any additional general comments about the program or program content, please explain.

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Project Title

Layered Curriculum for the Construction Trades: A Mathematics Curriculum to
Teach Trade Students Basic Math Skills to Be Successful Apprentices

Major Professor: Ratna Sinha, PhD