Assessment #8 –Content Competency Exam
Description of Assessment and Use

The Content Competency Exam is given prior to admission to the teacher education program and is part of a two-step process candidates must complete. Candidates usually take the exam during their junior year and must pass the exam and a follow-up interview before the department approves their admission to the teacher education program. The exam requires candidates to demonstrate their content knowledge of mathematical concepts taught at the secondary level. As such, a slightly different perspective on candidate content knowledge is produced. The items on this test were written to assess specific topics taught in high school mathematics and not necessarily topics covered in university courses. The exam consists of a total of 30 questions with two questions from the number and quantity domain, eight questions from algebra, eight questions from functions, eight questions from geometry, and eight questions from probability and statistics. The test was written by a group of mathematics education faculty members and reflects the statewide standards upon which Missouri high school students are assessed. While secondary mathematics topics cannot be assessed in their entirety in 30 questions, we believe the questions on the exam provide a representative picture of the content knowledge of our candidates.

Candidates must achieve 80% on the exam in order to pass. Upon completion and scoring of the exam, the candidate meets with a mathematics education faculty member to discuss the results. If a candidate does not score 80% on the first test, he or she must take another version of the exam after completing steps suggested by the teacher education program faculty. These suggested steps have included personal review, work with a faculty member, or taking a specific university course depending on the needs of the candidate. Upon successful completion of the content exam, our candidates schedule a department interview. This interview process is described in Assessment 7.

We have used the competency exam process for many years. However, we have only recently begun collecting data by domain. Previously, we simply used this test as a preliminary to our interview process (described in Assessment 7). We do feel that using the exam in this way allowed us to determine whether or not our candidates had sufficient content knowledge to teach; however, what we learned was incomplete as we did not have record of where our students struggled. Recording performance by mathematical strand has been a positive move for us as it allows faculty to have a more complete understanding of the content knowledge of individual candidates. This allows us to provide the additional support needed by a particular candidate. In addition, it provides us with valuable information for making curricular decisions.

The assessment instrument (with alignment to NCTM/CAEP standards, page 3), and data tables page 8) are included in this document. The packet students receive regarding this process (excluding the answer key) is included as a separate document.

Alignment with NCTM Standards

NCTM Standards/Indicators	Assessment Alignment with NCTM Standards/Indicators
Standard 1: **Content Knowledge, Element 1a** **As noted on the exam, items align specifically with A.1.1, A.1.3, A.2.1, A.2.1, A.2.3, A.2.4, A.3.1, A.3.3, A.3.4, A.3.7, A.3.9, A.4.3,**	During the exam process, candidates are asked to demonstrate their ability to solve and explain a variety of mathematical problem. The attached exam shows how each question aligns to the NCTM/CAEP Standards for Secondary Mathematics. Because the exam reflects the standards upon which high school students are assessed in Missouri, successful completion of the exam provides evidence that our candidates have the content

A.4.4, A.4.5	knowledge necessary to effectively teach secondary mathematics.

Strand and Exam Item Alignment

	Number and Quantity	Algebra	Functions	Geometry	Probability and Statistics
Items	1, 8	3, 5, 6, 9, 12, 13,15, 16	2, 4, 7, 10, 11, 13, 17, 18	19, 29, 21, 22, 23, 24, 25, 27	26, 28, 29, 30

Analysis of Findings

All of the completers from the time period of this report successfully passed the content exam and were admitted to the teacher education program. As noted earlier, our revised process of recording performance by mathematical strand has provided up with a great deal of knowledge regarding individual student strengths and weaknesses, as well as information needed for making curricular decisions. Because this exam is administered during the junior year, we have the opportunity to provide additional support to our students to ensure they are truly well-equipped with the content knowledge necessary to effectively teach secondary mathematics. While we have only collected data by strand for two semesters, some patterns have begun to emerge. Overall, our students answered 85% of the questions correctly and 100% of the students completing the exam were successful. Our students were quite successful on the items designed to measure number and quantity and functions (95.8% and 96.9% answered correctly respectively.) Our students did not score as well on geometry or probability and statistics (74.0% and 75.0% answered correctly).

Interpretation of the Findings

Our content competency exam aligns with many of the standards of the NCTM CAEP Mathematics Content for Secondary Addendum to the NCTM CAEP Standards 2012 (see standards noted on exam, page 3). We acknowledge that our findings are quite preliminary, but we believe that our revised process will provide very valuable data for future decisions.

We believe our evidence indicates that our students are particularly well-prepared in the areas of number and quantity, algebra, and functions. We believe this is partially due to the relatively recent requirement that our candidates take a course titled "Advanced Perspectives on High School Mathematics". This course focuses heavily on developing an understanding of functions. Candidates learn about functions and then are asked to prepare and teach lessons about various functions and their representations. Algebra topics are also a focus of this class.

While our candidates did not score as well on the probability and statistics portion of the test, most of the candidates had not taken the statistics and probability course required for certification prior to taking the content competency exam. Because our program is not large, many of our courses are only offered once per year. This means that many of our candidates are not able to take the probability and statistics course until the end of their junior year. Our candidates score well on the Data Analysis and Statistics portion of the Praxis II document and we believe this indicates sufficient content knowledge in this area.

We were concerned by the relatively low scores on the geometry items. While our students performance in geometry on the Praxis II is acceptable (62.5% correct), there is certainly room for improvement. During advisory board meetings, several of our candidates and graduates have expressed a lack of confidence in the area of geometry. Partially because of this finding, we have added a course titled "Advanced Perspectives on Secondary Geometry and Trigonometry" as a certification requirement. We believe this addition of this course will ensure our candidates are well-prepared to teach geometry.

Content Competency Exam

NCTM/CAEP Standard is found in bold print in front of each question.

A.1.3   1) Kerosene has an approximate density of 0.82 $\frac{g}{mL}$. Find the mass of 30 L of kerosene.

A.2.3   2) Find the vertex. $y = x^2 - 6x - 16$

A.2.2   3) Solve. $\log(3x + 5) - \log(2x + 4) = 0$

A.2.3   4) Determine the end behavior of the following equation. $4x^4 - 6x^3 + 3x = y$

A.2.1   5) Solve and graph. $|3x + 5| \leq 17$

A.2.1   6) Solve and graph. $\left(\frac{x+5}{x+2}\right) < 0$

A.2.1   7) Find f(0), given $f(x) = \begin{cases} 6x - 1, & x < 0 \\ 7x + 3, & x \geq 0 \end{cases}$

A.1.1   8) Simplify completely. $(25x^4y^6)^{\frac{1}{2}} * (x^3y^4)$

A.2.4   9) One day a store sold 30 sweatshirts. White ones cost $9.95 and red ones cost $10.50. In all $310.60 worth of sweatshirts were sold. How many of each were sold?

A.2.4   10) The number of students working the concession stands at a football game can be represented by the equation $f(x) = \frac{x}{50}$, where x is the number of tickets sold. What does f(3050) represent in the context of the problem?

A.2.3 11) Identify the type of function for f(x), g(x), and h(x). (i.e., linear, exponential, etc.)

x	f(x)	g(x)	h(x)
-2	-2	9	1/9
-1	1	3	1/3
0	4	1	1
1	7	3	3
2	10	9	9

A.2.4 12) Solve the following system of equations.

$$y = x^2 - 2x - 1$$

$$y = x + 3$$

A.2.3 13) Write the equation of the transformation.

Square root function shifted right 2, down 3, and vertically compressed by a factor of 4.

A.2.4 14) You are having your floor tiled. It costs $1140 for your 180 sq. ft., kitchen and $348 for the adjoining laundry room, which is 48 sq. ft. What is the slope of the function and what does it represent in the context of this problem?
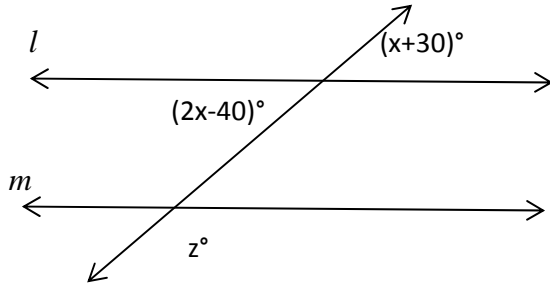
A.2.2 15) Solve. $\sqrt{x + 3} = x - 3$

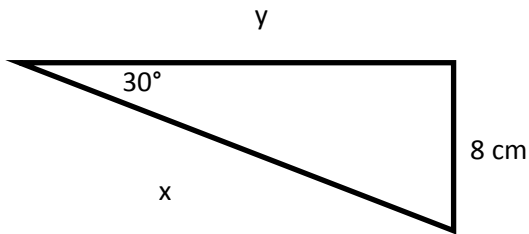**A.2.2** 16) Solve. $\dfrac{3}{x+2} + \dfrac{2}{x-2} = \dfrac{8}{x^2-4}$

A.2.1 17) Given $f(x) = 3x - 9 \ and \ g(x) = -6x^2 + 2x - 1$, find g(f(2)).

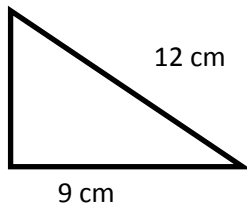**A.2.2** 18) Given $f(x) = 4x^2 - 9$, find $f^{-1}(x)$.
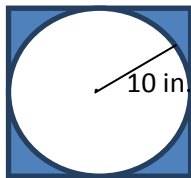
A.3.1   19) Find the values for x and z, given $l//m$.

l

$(x+30)°$

$(2x-40)°$

m

$z°$

A.3.4   20) Find the side lengths of x and y, given the right triangle.

y

30°

8 cm

x

A.3.7   21) Find the area of the right triangle.

12 cm

9 cm

A.3.7   22) Find the area of the shaded region.

10 in.

A.3.1   23)

Given circle D.

Find $m\widehat{BC}$.

B

D

$(2x-30)°$

A

C

$x°$
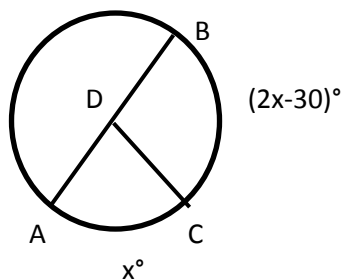
A.3.7 24) Find the volume.

15 cm

10 cm
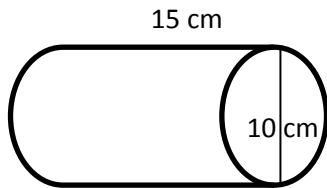
A.3.9 25) Write the equation of the ellipse with vertices at (-3, 3), (1, 4), (5, 3), and (1, 2).

A.4.3 26) Given the following data, create and label a box and whisker plot.

Age of Oscar Winning Actresses since 1992

Name	Age	Name	Age
Jodie Foster	26	Emma Thompson	33
Holly Hunter	36	Jessica Lange	45
Susan Sarandon	49	Frances McDormand	39
Helen Hunt	34	Gwyneth Paltrow	26
Hilary Swank	25	Julia Roberts	33
Halle Berry	35	Nicole Kidman	35
Charlize Theron	28	Hilary Swank	30
Reese Witherspoon	29	Helen Miren	61
Marion Cotillard	32	Kate Winslet	33
Sandra Bullock	45	Natalie Portman	29
Meryl Streep	62	Jennifer Lawrence	22

A.3.3 27) Find the approximate length of segment HJ in the diagram below.

G

K

100 cm

80 cm

30°   60°

H   I   J
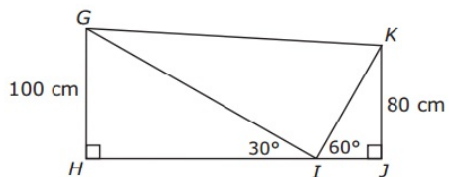
A.4.5 28) A couple has three children. Find the probability that they have three daughters.

A.4.4 29) Students in the union were surveyed and classified by gender and year in school.

Using the data, what is the probability that a random person from the sample is a male, given that he is a junior?

	Freshman	**Sophomore**	**Junior**	**Senior**	**Total**
Male	180	208	103	162	653
Female	76	132	261	158	657
Total	256	340	364	320	1280

A.4.4 30) Use probability rules to find the probability that when one card is chosen from a full deck of cards without jokers that the card is: a. a queen and a heart   b. a queen or a heart

Data Tables
Content Competency Exam

As noted earlier in this document, we did not record data by strand for the candidates described in the three years reflected in our report. Therefore, we are including two data tables reflecting the change in how we record data. The first represents data for the 22 candidates described in this report. The second table represents the first data we've collected using our new procedure.

Content Competency Exam
Completers - 2010 – 2013

Year of Completion of Program	Candidate	Pass/Fail
2010-2011	1	Pass
	2	Pass
	3	Pass
	4	Pass
	5	Pass
	6	Pass
	7	Pass
2011-2012	8	Pass
	9	Pass
	10	Pass
	11	Pass
	12	Pass
2012-2013	13	Pass
	14	Pass
	15	Pass
	16	Pass
	17	Pass
	18	Pass
	19	Pass
	20	Pass
	21	Pass
	22	Pass

Content Competency Exam
2013-2014

Semester	Candidate	Number and Quantity 4 possible	Algebra 16 possible	Functions 16 possible	Geometry 16 possible	Probability and Statistics 8 possible	TOTAL 60 possible	Pass or Fail
Fall 2013	1	4	14	16	10	6	50/60 83.3%	Pass
	2	4	16	16	13	7	56/60 93.3%	Pass
	3	3	15	15	11	4	48/50 80%	Pass
	4	4	10	16	16	6	52/60 86.7%	Pass
Spring 2014	5	4	15	15	10	6	50/60 83.3%	Pass
	6	4	13	15	11	7	50/60 83.3%	Pass
	Mean Scores	3.83/4 95.8%	13.8/16 86.5%	15.5/16 96.9%	11.8/16 74.0%	6/8 75.0%	51/60 85%	100% Pass on first attempt