GENERAL CURRICULUM TEST

Sample Mathematics Items
and Commentary

7 January 2007

At its December meeting, the Board of Education supported the Commissioner's determination that the General Curriculum MTEL examination needs to be revised to provide a higher level of assurance that candidates for teacher licenses at the elementary level are sufficiently competent in mathematics. We will create a mathematics subtest that will have its own passing score by increasing the number of items from 18 to 40 and strengthening the items to ensure both computational fluency and depth of understanding of the content. Following is a brief analysis of the types of items on the current test and options for how they can be strengthened as we develop the new subtest. In order to maintain the confidentiality of the General Curriculum test, these examples are drawn from the recently developed practice test.

Five practice MTEL examinations have been posted to date on the WEB at the following address: http://www.mtel.nesinc.com/MA_PT_opener.asp They are:
- Communication & Literacy Skills (separate Reading and Writing subtests)
- Early Childhood
- General Curriculum
- Mathematics (secondary)
- Foundations of Reading

The Practice Tests posted by NES were developed using the same specifications and procedures that are used to develop the actual MTEL examinations. There are eighteen mathematics items that are counted toward the examinee's total score on the General Curriculum test. The following five items have been taken from the "General Curriculum Practice Test" that is posted at the following WEB address: http://www.mtel.nesinc.com/PDFs/MA_FLD003_PRACTICE_TEST.pdf

These sample mathematics items represent the range of difficulty, from very easy to moderately challenging, that examinees encounter when they take the actual test. These items are followed by our evaluation of their suitability and some examples of how items on an expanded (40 item) mathematics subtest could be developed to improve our assessment of the mathematics knowledge of candidates for the teaching licenses at the elementary level.

27. The product of 2 and 98 can be determined by viewing the problem as $2 \times (100 - 2)$ and using which of the following number properties?

   A.   distributive

   B.   associative

   C.   commutative

   D.   transitive

38. A building contractor has n days to complete a house project. If he uses one-third of the time to repair the roof and five days to paint the house, how many days will he have left to complete the project?

   A. $\frac{1}{3}n + 5$

   B. $\frac{1}{3}n - 5$

   B. $\frac{2}{3}n + 5$

   D. $\frac{2}{3}n - 5$

39. The equation $x = \frac{7}{8}y + 18$ can be solved for y to yield which of the following?

   A. $y = 8/7x - 18$

   B. $y = \frac{7}{8}x + 18$

   C. $y = 8/7(x - 18)$

   D. $y = \frac{7}{8}(18 - x)$

41. Use the diagram below to answer the question that follows.
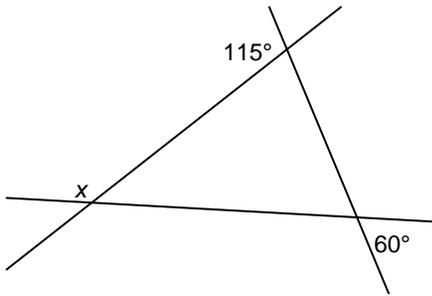
Three straight lines intersect to form a triangle, as shown above.
What is the measure of angle x?

A. 115°

B. 120°

C. 125°

D. 130°

42. A homeowner is planning to use carpet tiles to cover the floor of a room measuring 10 feet by 10 feet. If the carpet tiles are 8 inches wide and 1 foot long, and there are no gaps between the tiles as they are placed on the floor, how many carpet tiles will the homeowner need to cover the floor of the room?

A. 125

B. 150

C. 800

D. 1,800

EVALUATION OF ITEMS & POSSIBLE ALTERNATIVES

Item #27: This item addresses a very important component of "Number Sense and Operations," the Distributive Property. The problem is that it does so at the most trivial level, i.e., simply knowing enough about this property to recognize an instance of its use.

    Alternative (a) (Open Response):
    At the end of his "Math Concepts I" course, Mathematics Professor Richard Bisk, Worcester State College, poses the following problem to his students:
    " Use the distributive property and the fact that 999 = 1000-1 to find 999 x 213. You must show correct work to receive credit. "

    In this example the examinee is asked to apply knowledge of the distributive property to demonstrate how the computational complexity of the problem can be simplified through its application.

    Alternative (b) (Multiple Choice):
    The following (released) MCAS item tests application of several properties and a misapplication of the associative property:

    Which of the following statements is false?

    A. $(-12)(-12)(-12) = 3(-12)$
    B. $12(4-1) = 12(4) - 12(1)$
    C. $12 + (4-1) = (12 + 4) - 1$
    D. $-12 + 12 = 12 + (-12)$

Item #38: This item addresses an important component of "Patterns, Relations and Algebra," solving a problem for one of two unknowns. It challenges the examinee's understanding of the underlying concept and, at the same time, requires the application of procedures to isolate one of the unknowns AND to go beyond the obvious and find the remainder that's actually what's being sought. This is a multi-step item of moderate difficulty and represents an appropriate measure of the mathematics competence of teachers licensed to cover material through the grade 6 standards.

Item #39: This item addresses the same "solve a problem for one of two unknowns" as does item #38, but does so in a relatively trivial, rote manner – solve for the embedded unknown presented as solved for the other. It weakens the test to include items that place such limited demands on the examinee, particularly when more appropriate items (e.g., #38) are available.

Item #41:   This item addresses the "Geometry" strand. It is a multi-step problem that requires an understanding and application of multiple relationships of angles created by intersecting straight lines and within a triangle. It is of easy to moderate difficulty and adequately measures the competence of an elementary teacher candidate in this domain.

Alternative:
The following (released) MCAS multiple choice item tests adjacent angles and angles in right triangles within a real-world context:

Each of the two interior supports for part of a roof is perpendicular to a rafter, as shown below.
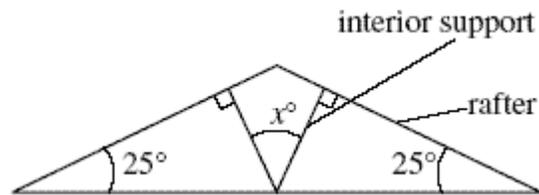
**What is *x*, the measure, in degrees, of the angle formed by the two interior supports?**

    A.   50

    B.   65

    C.   90

    D.   130

Item #42:   This item also addresses the "Geometry" strand. It is a multi-step problem (converting measurements, multiplying and dividing) but at a simple level and within a simple context.

Alternative:
The following (released) MCAS open response item involves adding feet and inches together, along with determining perimeter and area of a complex figure:

A park has a rose garden with the dimensions shown below. A 36-inch-wide sidewalk surrounds the rose garden.

Map of Park
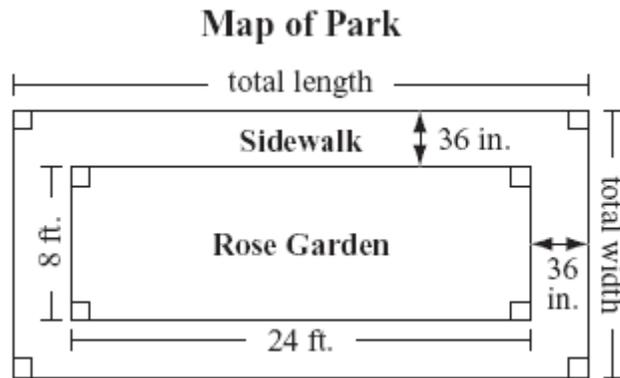
a. What are the total length and the total width, in **feet**, of the park? Show or explain how you got your answers.

b. What is the perimeter, in **feet**, of the park? Show or explain how you got your answer.

c. What is the area, in **square feet**, of the entire sidewalk? Show or explain how you got your answer.