



**NEW ENGLAND
COMMON ASSESSMENT PROGRAM**

**Released Items
Support Materials
2006**

**Grade 8
Mathematics**

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

N&O 7.2 Demonstrates understanding of the relative magnitude of numbers by ordering, comparing, or identifying equivalent rational numbers across number formats, numbers with whole number bases and whole number exponents (e.g., 3^3 , 4^3), integers, absolute values, or numbers represented in scientific notation using number lines or equality and inequality symbols.



1 Which mixed number is equivalent to 1.375?

- A. $1\frac{1}{3}$
- B. $1\frac{3}{8}$
- C. $1\frac{2}{5}$
- D. $1\frac{3}{4}$

N&O 7.4 Accurately solves problems involving proportional reasoning; percents involving discounts, tax, or tips; and rates. (IMPORTANT: *Applies the conventions of order of operations including parentheses, brackets, or exponents.*)



2 Katie makes a necklace using the pattern of 2 red beads followed by 3 blue beads. She uses a total of 75 beads for the necklace. How many red beads does Katie use?

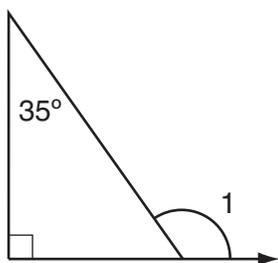
- A. 25
- B. 30
- C. 45
- D. 50

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

G&M 7.2 Applies theorems or relationships (triangle inequality or sum of the measures of interior angles of regular polygons) to solve problems.



3 Look at this diagram.



What is the measure of $\angle 1$?

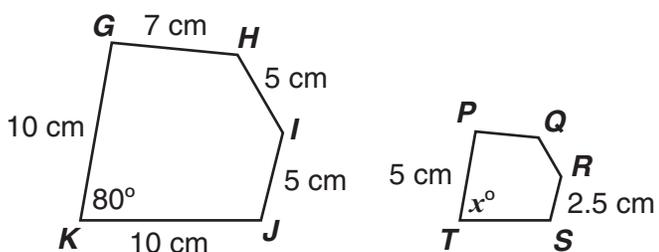
- A. 55°
- B. 115°
- C. 125°
- D. 135°

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GRADE 8 MATHEMATICS

G&M 7.5 Applies concepts of similarity by solving problems involving scaling up or down and their impact on angle measures, linear dimensions and areas of polygons, and circles when the linear dimensions are multiplied by a constant factor. Describes effects using models or^{sc} explanations.



- 4 Pentagon $GHIJK \sim$ pentagon $PQRST$.



What is the value of x ?

- A. 40
- B. 80
- C. 100
- D. 160

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

F&A 7.1 Identifies and extends to specific cases a variety of patterns (linear and nonlinear) represented in models, tables, sequences, graphs, or in problem situations; **and generalizes a linear relationship using words and symbols**; generalizes a linear relationship to find a specific case; or writes an expression or^{sc} equation using words or^{sc} symbols to express the generalization of a nonlinear relationship.

- 5 Julia's phone calling plan is based on a set price of \$24.00 a month for local calls and \$0.04 a minute for long distance calls. If Julia makes m minutes of long distance calls in a month, which expression represents her cost, in dollars, for that month?
- A. $m(24.00 - 0.04)$
 - B. $m(24.00 + 0.04)$
 - C. $24.00m + 0.04$
 - D. $24.00 + 0.04m$

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

F&A 7.1 Identifies and extends to specific cases a variety of patterns (linear and nonlinear) represented in models, tables, sequences, graphs, or in problem situations; **and generalizes** a linear relationship using words and symbols; generalizes a linear relationship to find a specific case; or writes an expression or^{sc} equation using words or^{sc} symbols to express the generalization of a nonlinear relationship.

- 6 Dan is filling a swimming pool with water at a constant rate. The table below shows the depth of the water over time.

Time Filling (in hours)	Depth of Water (in feet)
1	$1\frac{1}{2}$
2	2
3	$2\frac{1}{2}$
4	3

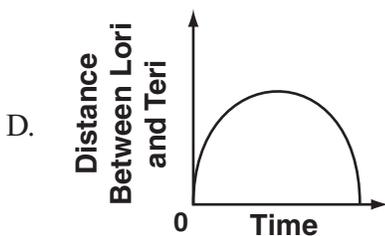
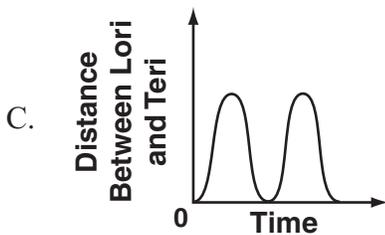
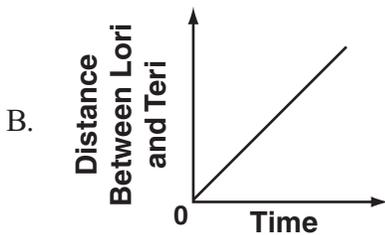
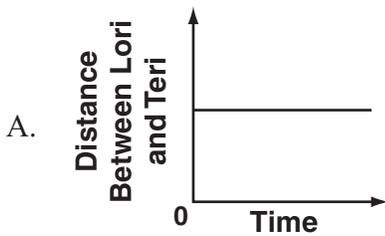
How can Dan calculate the depth of the water after 6 hours of filling?

- A. Multiply $\frac{1}{2}$ by 6 and add 1.
- B. Multiply $1\frac{1}{2}$ by 6.
- C. Multiply $2\frac{1}{2}$ by 2.
- D. Multiply 1 by 6 and add $\frac{1}{2}$.

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

F&A 7.2 Demonstrates conceptual understanding of linear relationships ($y = kx$; $y = mx + b$) as a constant rate of change by solving problems involving the relationship between slope and rate of change, by describing the meaning of slope in concrete situations, or informally determining the slope of a line from a table or graph; and distinguishes between constant and varying rates of change in concrete situations represented in tables or graphs; or describes how change in the value of one variable relates to change in the value of a second variable in problem situations with constant rates of change.

- 7 Lori is riding her bicycle around a circular track. Teri is standing at the center of the track. Which graph shows how the distance between Lori and Teri relates to the time since Lori started riding?



NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

F&A 7.3 **Demonstrates conceptual understanding of algebraic expressions** by using letters to represent unknown quantities to write algebraic expressions (including those with whole number exponents or more than one variable); or by evaluating algebraic expressions (including those with whole number exponents or more than one variable); or by evaluating an expression within an equation (e.g., determine the value of y when $x = 4$ given $y = 5x^3 - 2$).

- 8 Kate uses the formula below to calculate the volume of a sphere with radius r .

$$V = \frac{4}{3}\pi r^3$$

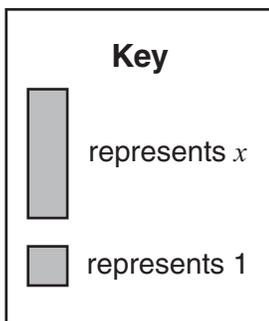
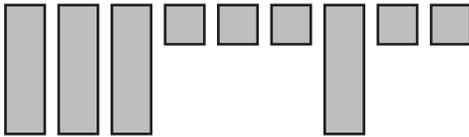
What is the approximate volume of a sphere with a radius of 3 inches? (π is approximately 3.14)

- A. 113 cubic inches
- B. 339 cubic inches
- C. 1017 cubic inches
- D. 3052 cubic inches

NECAP 2006 RELEASED ITEMS
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9 Look at this model.



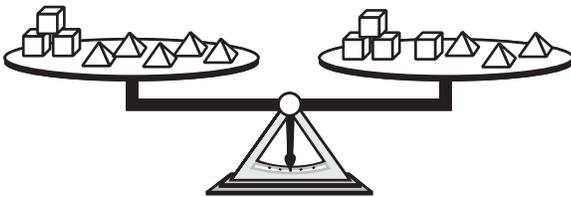
Which expression does the model show?

- A. $9x$
- B. $4x + 5$
- C. $x^4 + 5x$
- D. $x^4 + 5$

**NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS**

F&A 7.4 **Demonstrates conceptual understanding of equality** by showing equivalence between two expressions (expressions consistent with the parameters of the left- and right-hand sides of the equations being solved at this grade level) using models or different representations of the expressions, solving multi-step linear equations of the form $ax \pm b = c$ with $a \neq 0$, $ax \pm b = cx \pm d$ with $a, c \neq 0$, and $(x/a) \pm b = c$ with $a \neq 0$, where a, b, c and d are whole numbers; or by translating a problem-solving situation into an equation consistent with the parameters of the type of equations being solved for this grade level.

- 10 The scale shown below is balanced.



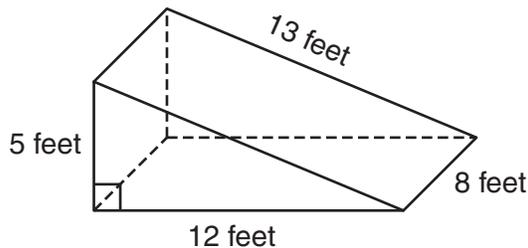
Which statement is true?

- A. $\triangle \triangle \triangle \triangle$ weighs the same as $\square \square$
- B. $\triangle \triangle$ weighs the same as $\begin{matrix} \square \square \square \\ \square \square \square \square \end{matrix}$
- C. $\begin{matrix} \triangle \triangle \triangle \triangle \\ \triangle \triangle \triangle \triangle \end{matrix}$ weighs the same as \square
- D. $\begin{matrix} \triangle \triangle \triangle \triangle \\ \triangle \triangle \triangle \triangle \end{matrix}$ weighs the same as $\begin{matrix} \square \square \square \\ \square \square \square \square \end{matrix}$

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

G&M 7.6 Demonstrates conceptual understanding of the area of circles or the area or perimeter of composite figures (quadrilaterals, triangles, or parts of circles), and the surface area of rectangular prisms, or volume of rectangular prisms, triangular prisms, or cylinders using models, formulas, or by solving related problems. Expresses all measures using appropriate units.

- 11 The ramp shown below is a triangular prism.



What is the volume of the ramp in cubic feet?

Scoring Guide

Score	Description
1	Student gives the correct answer, 240 (cubic feet) .
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 1
(EXAMPLE A)

The volume of the ramp is 240 cubic feet.

$$\begin{array}{r} \times 30 \\ \hline 240 \end{array}$$

Student's answer
is correct.

SCORE POINT 0
(EXAMPLE A)

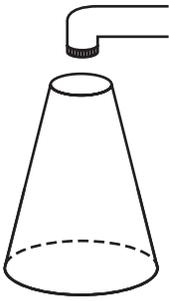
480 ft³

Student's answer is incorrect.

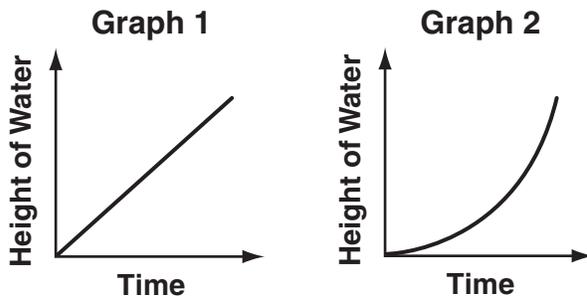
NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

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- 12 Look at this container.



Water flows into this container at a constant rate. Look at Graph 1 and Graph 2 below.



Explain how you know which graph best represents the height of the water over time.

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

Scoring Guide

Score	Description
1	Student gives a correct explanation.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Sample Response:

Graph 2 best represents the height of the water because the height will increase faster as the container gets more narrow.

SCORE POINT 1
(EXAMPLE A)

Graph 2 because as the glass gets taller, the width is smaller so the water rises faster.

Student's explanation is correct.

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 0
(EXAMPLE A)

Graph 1 best represents the water because, the water flow is at a constant rate which the graph shows it being.

Student's explanation is incorrect (may not have considered the rate at which the height of the water increases over time due to the shape of the container).

SCORE POINT 0
(EXAMPLE B)

Graph 1 Graph 2 Graph 2



Student chooses the correct graph but provides no explanation.

**NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS**

N&O 7.4 **Accurately solves problems involving** proportional reasoning; percents involving discounts, tax, or tips; and rates. (IMPORTANT: *Applies the conventions of order of operations including parentheses, brackets, or exponents.*)



- 13** Larry buys a sweater that has a regular price of \$40. The sweater is on sale for 30% off. What is the sale price of the sweater? Show your work or explain how you know.

Scoring Guide

Score	Description
2	Student gives the correct answer, \$28 , with work shown.
1	Student gives the correct answer, with incomplete or no work shown. OR Student gives an incorrect answer, with a correct strategy.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Sample Responses:

$\$40 \times 0.3 = \12 ; he will save \$12.

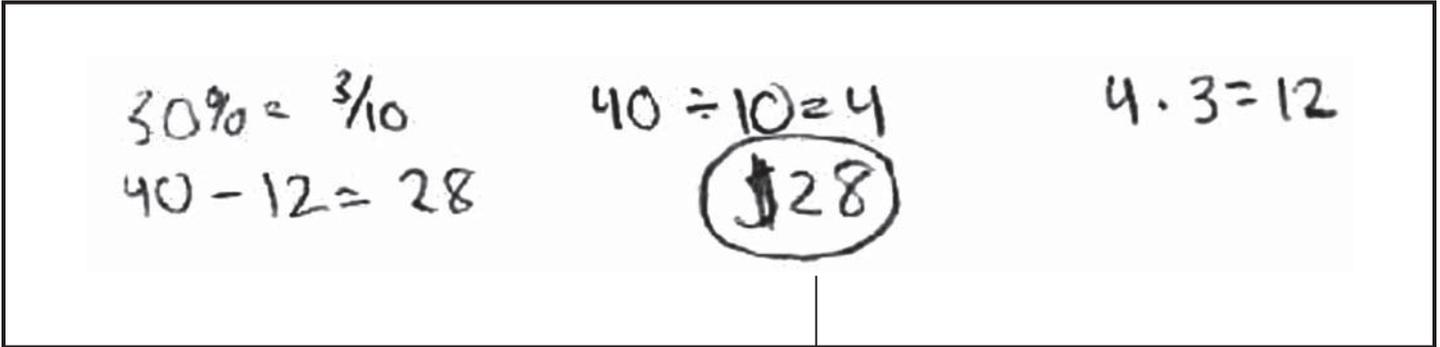
$\$40 - \$12 = \$28$; the sale price is \$28.

OR

$\$40 \times 0.7 = \28 .

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GRADE 8 MATHEMATICS

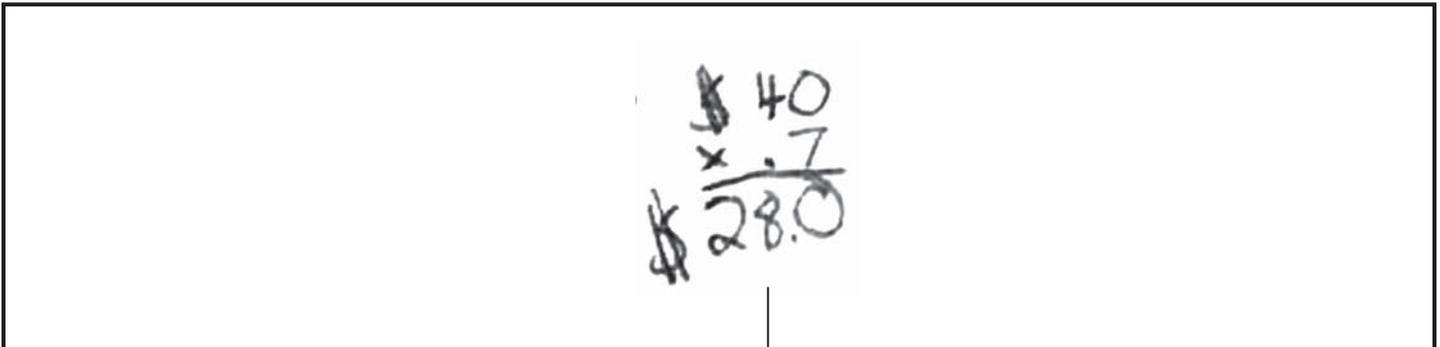
SCORE POINT 2
(EXAMPLE A)



Handwritten student work showing three calculations: $30\% = \frac{3}{10}$, $40 - 12 = 28$, $40 \div 10 = 4$, and $4 \cdot 3 = 12$. The final answer, $\$28$, is circled.

Student's answer is correct,
with work shown. (2 points)

SCORE POINT 2
(EXAMPLE B)



Handwritten student work showing a multiplication problem: $\$40 \times .7 = \28.0 .

Student's answer is correct,
with work shown. (2 points)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 1
(EXAMPLE A)

$$\begin{array}{r} \$40.00 \\ -12.00 \\ \hline 28.00 \end{array}$$

\$28.00

Student's answer is correct, with incomplete work shown (does not show how to get the \$12.00). (1 point)

SCORE POINT 0
(EXAMPLE A)

It would be 5 to 10 dollars because $\frac{1}{4}$ of it off would be 10 dollars so its 30% percent so it is less.

Student's answer and explanation are incorrect. (0 points)

**NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS**

G&M 7.5 Applies concepts of similarity by solving problems involving scaling up or down and their impact on angle measures, linear dimensions and areas of polygons, and circles when the linear dimensions are multiplied by a constant factor. Describes effects using models or^{sc} explanations.

- 14 Triangle ABC has a base of 5 inches and a height of 4 inches. Triangle ABC is similar to triangle DEF . Triangle DEF has dimensions that are 3 times as great as those of triangle ABC . **How many times as great** is the area of triangle DEF compared to the area of triangle ABC ? Show your work or explain how you know.

Scoring Guide

Score	Description
2	Student gives the correct answer, 9 (times as great) , with explanation given or work shown.
1	Student gives the correct answer. OR Student's explanation or work indicates some understanding of the role of proportionality in similar figures.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

Sample Responses:

Area of $\triangle ABC = \frac{1}{2}(5 \times 4) = 10$ square inches.

$\triangle DEF$: base = 15 inches, height = 12 inches, area = $\frac{1}{2}(15 \times 12) = 90$ square inches;

$90 \div 10 = 9$. So the area of $\triangle DEF$ is **9 times as great** as the area of $\triangle ABC$.

OR

The area of a triangle is $\frac{1}{2}bh$. If the base and the height of a triangle both triple, then the area of the new triangle is $\frac{1}{2}(3b)(3h)$ or $9(\frac{1}{2}bh)$. So the area of $\triangle DEF$ is **9 times as great** as the area of $\triangle ABC$.

OR

$$3^2 = 9$$

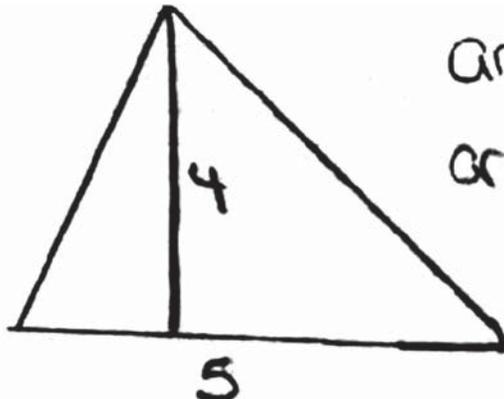
SCORE POINT 2
(EXAMPLE A)

Tri. ABC - $b = 5 \text{ in}$ $h = 4 \text{ in}$
Tri DEF - $b = 5 \cdot 3$ $h = 4 \cdot 3$
 $b = 15$ $h = 12$
 $15 \cdot 12 = 180 \text{ in}^2$
Area of tri DEF = $\frac{180 \text{ in}^2}{2} = 90 \text{ in}^2$
Area of tri ABC = $\frac{5 \cdot 4}{2} = \frac{20 \text{ in}^2}{2} = 10 \text{ in}^2$
triangle DEF is 9 times greater than the area of ABC.

Student's answer and explanation are correct. (2 points)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 1
(EXAMPLE A)



Area of $ABC = (5 \div 2) \cdot 4 = 10$
Area of $DEF = (15 \div 2) \cdot 12 = 90$

Student's work indicates some understanding of proportionality (the dimensions of triangle DEF are 3 times the dimensions of triangle ABC) but does not provide an answer. (1 point)

SCORE POINT 0
(EXAMPLE A)

$$\begin{array}{r} \times 5 \\ 4 \\ \hline 20 \end{array}$$
$$\begin{array}{r} \times 15 \\ 12 \\ \hline 180 \end{array}$$

Triangle DEF is 160 times greater than triangle ABC .

Student's answer and explanation are incorrect (used additive rather than multiplicative reasoning). (0 points)

**NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS**

DSP 7.5 For a probability event in which the sample space may or may not contain equally likely outcomes, **determines** the experimental or theoretical probability of an event in a problem-solving situation.

- 15 When a knight sets out on a quest, he must choose a road to follow.
- 3 out of every 5 knights take the High Road. The others take the Low Road.
 - Of the knights taking the High Road, 80% are successful in their quest. The others fail.
 - Of the knights taking the Low Road, 40% are successful in their quest. The others fail.
- a. A knight is chosen at random. What is the probability he will take the Low Road? Show your work or explain how you know.
- b. A knight is chosen at random. What is the probability he will take the High Road and succeed in his quest? Show your work or explain how you know.

**NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS**

Scoring Guide

Score	Description
4	4 points
3	3 points
2	2 points
1	1 point OR Student shows minimal understanding of finding probabilities of compound events.
0	Response is incorrect or contains some correct work that is irrelevant to the skill or concept being measured.
Blank	No response

Training Notes:

Part a: 2 points for correct answer, $\frac{2}{5}$ or equivalent (2 out of 5, 40%, etc.), and explanation
OR
1 point for correct answer
or
for explanation indicating correct strategy, $1 - \frac{3}{5}$

Part b: 2 points for correct answer, $\frac{12}{25}$ or 0.48 or equivalent, and explanation
OR
1 point for correct answer
or
for explanation indicating correct strategy (may consist of multiplied probabilities, diagram, tree diagram, or other)

Sample Responses:

Part a: If 3 out of 5 knights take the High Road, that leaves $1 - \frac{3}{5} = \frac{2}{5}$ probability of taking the Low Road.

Part b: $\frac{3}{5} \times \frac{8}{10} = \frac{24}{50} = \frac{12}{25}$

OR

$0.6 \times 0.8 = 0.48$

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 4
(EXAMPLE A)

a. $\frac{3}{5}$ knights = High Road $\frac{2}{5}$ = Low Road

$\frac{3}{5} - \frac{3}{5} = \frac{2}{5}$ knights take the Low Road probability is $\frac{2}{5}$ or 40%

b. $\frac{3}{5}$ knights \leftarrow 80% succeed.

60% knights \leftarrow 80% succeed

$\frac{12 \text{ knights}}{5 \times 60 \text{ knights}} \leftarrow \frac{80}{100} = \frac{8}{10} = \frac{4}{5}$

$\begin{array}{r} 12 \\ \times 4 \\ \hline 48 \end{array}$

$\frac{48 \text{ knights}}{100 \text{ knights}} = \frac{24}{50} = \frac{12}{25}$ or 48%

b) Student's answer is correct, with work shown. (2 points)

a) Student's answer is correct, with work shown. (2 points)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 3
(EXAMPLE A)

A $\frac{2}{5}$ chance for the Low Road

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$$

a) Student's answer is correct, with work shown. (2 points)

B $\frac{3}{5}$ of a chance for the High road and 48% chance he will succeed.

b) Student's answer is correct, with no work shown. (1 point)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 2
(EXAMPLE A)

a. $\frac{3}{5}$ take high Road] $\frac{2}{5}$ take Low Road

$$\frac{5}{5} - \frac{3}{5} = \frac{2}{5}$$

a) Student's answer is correct, with work shown. (2 points)

b. $\frac{3}{5}$ take High Road

80% succeed

$$\frac{80}{100} = \frac{4}{5} \text{ succeed}$$

$$\left. \begin{array}{l} \frac{3}{5} \text{ take High Road} \\ \frac{4}{5} \text{ succeed} \end{array} \right\} = \frac{4}{5} - \frac{3}{5} = \frac{1}{5} = \text{probability that he will succeed on High Road}$$

b) Student's answer and work are incorrect. (0 points)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 1
(EXAMPLE A)

A.

$$\frac{2}{5}$$

a) Student's answer is correct,
with no explanation given or
work shown. (1 point)

B.

$$\frac{2}{9}$$

b) Student's answer is incorrect,
with no explanation given or
work shown. (0 points)

NECAP 2006 RELEASED ITEMS
GRADE 8 MATHEMATICS

SCORE POINT 0
(EXAMPLE A)

I think he would probably take the high road if he knew how many per
A, more successful on that one than the low road. The probability he would take the high road is $\frac{1}{2}$ out of 2 chance.

B. The probability he would take the high road is one out of two. Probability he would succeed is 20%. I got this by 80% (high) succeeding and 4% (low) failing, 20% left so has 20 out of 80 chance.

a) Student's answer and explanation are incorrect. (0 points)

b) Student's answer and explanation are incorrect. (0 points)