90 min (NO MORE)

Student Name: Key

Spring 2013
North Carolina
Measures of Student Learning:

NC's Common Exams
Common Core Math II

Student Booklet

Public Schools of North Carolina
State Board of Education
Department of Public Instruction
Raleigh, North Carolina 27699-6314

1 The equation $s = 2\sqrt{5x}$ can be used to estimate the speed, s, of a car in miles per hour, given the length in feet, x, of the tire marks it leaves on the ground. A car traveling 90 miles per hour came to a sudden stop. According to the equation, how long would the tire marks be for this car?

A 355 feet

B 380 feet

C 405 feet

D 430 feet

90m/hr = speed(s)

(check by plugging in & solving)

① $90 = 2\sqrt{5x}$

② $\frac{90}{2} = \frac{2\sqrt{5x}}{2}$

③ $(\sqrt{5x})^2 = (45)^2$

④ $5x = 2,025$

⑤ $\frac{5x}{5} = \frac{2,025}{5}$

⑥ $x = 405$

2 The heights of two different projectiles after they are launched are modeled by $f(x)$ and $g(x)$. The function $f(x)$ is defined as $f(x) = -16x^2 + 42x + 12$. The table contains the values for the quadratic function g.

↳ MAX (1.3, 39.56)

x	g(x)
0	9
1	33
2	25

2nd trace - MIN/MAX

→ Get Quadratic equation using STAT #5

$y = -11ex^2 + 40x + 9$

↳ MAX (1.25, 34)

What is the ***approximate*** difference in the maximum heights achieved by the two projectiles?

$39.56 - 34 = 5.56$

A 0.2 feet

B 3.0 feet

C 5.4 feet

D 5.6 feet

Go to the next page.

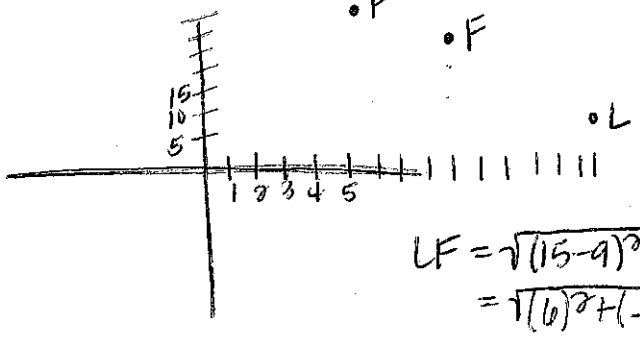
3 A city map is placed on a coordinate grid. The post office is located at the point $P(5, 35)$, the library is located at the point $L(15, 10)$, and the fire station is located at the point $F(9, 25)$. What is the ratio of the length of $\overline{PF}$ to the length of $\overline{LF}$?

A 2 : 3

B 3 : 2

C 2 : 5

D 3 : 5



distance $d = \sqrt{(x-x)^2 + (y-y)^2}$

$PF = \sqrt{(5-9)^2 + (35-25)^2} = \sqrt{(-4)^2 + (10)^2}$

$LF = \sqrt{(15-9)^2 + (10-25)^2} = \sqrt{(6)^2 + (-15)^2} = \sqrt{261}$

$= \sqrt{116}$

*PF : LF

$\sqrt{116} / \sqrt{261} \rightarrow 2/3$

4 Twenty-one students at a school have an allergy to peanuts, shellfish, or both.

- Fourteen students at the school are allergic to peanuts.
- Twelve students at the school are allergic to shellfish.

How many of the students are allergic to both peanuts and shellfish?

A 12

B 7

C 5

D 2

14 Peanuts
+12 Shellfish
26 Total, but only 21 students
so $26 - 21 = 5$ must be allergic to both.

5 Events M and N have probabilities such that $P(M) = 0.4$, $P(N) = 0.28$, $P(M \cup N) = 0.56$, and $P(M \cap N) = 0.12$. Are event M and event N independent?

A no, because $P(M) - P(N) = P(M \cap N)'$

B no, because $P(M) \cdot P(N) \neq P(M \cap N)$

C yes, because $P(M) + P(N) = P(M \cup N)$

D yes, because $P(M) \cdot P(N) \neq P(M \cup N)$

∪ = union (OR)

∩ = intersection (AND)

Notes: • IND & DEP are AND problems
• MUT. EX. & NOT MUT. EX. are OR problems

(can't happen same time) (can happen same time)

+/−

Go to the next page.

6 Which expression is equivalent to $(3x^5 + 17x^3 - 1) + (-2x^5 - 6)$?

A $x^5 + 17x^3 - 7$

B $x^5 - 11x^3 - 1$

C $5x^5 + 17x^3 + 7$

D $-6x^5 + 17x^3 + 6$

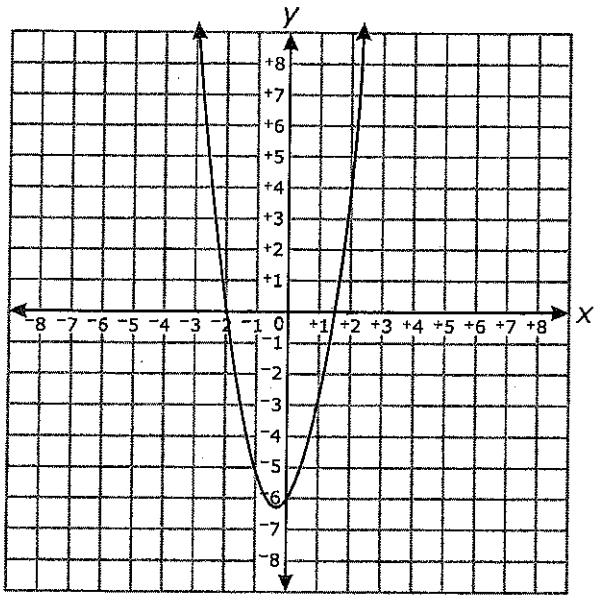
$1x^5 + 17x^3 - 7$

* Keep exponents the same when +/- (only add exp. when x).

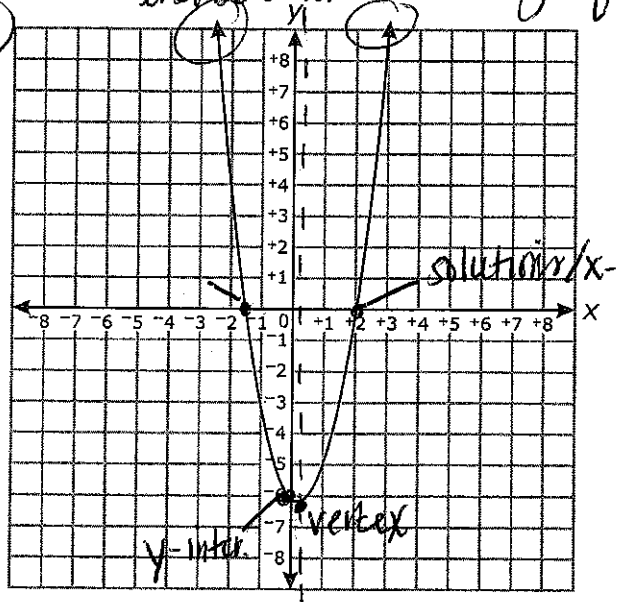
Go to the next page.

7 Which graph displays the function $f(x)=(2x+3)(x-2)$?

A



B



end behavior + increasing left / + increasing right

quadratic

domain $(-\infty, \infty)$ ℝ

range $(-6, \infty)$

solutions/x-intercepts/zeros (2)

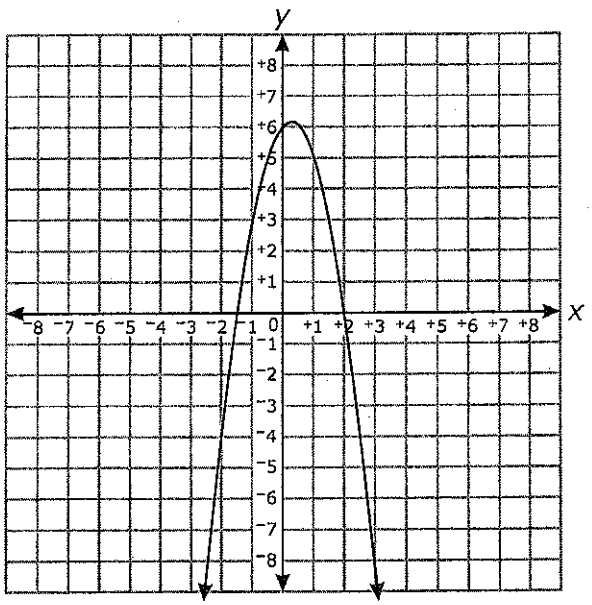
+ positive discriminant

axis of sym. $x = 0.25$

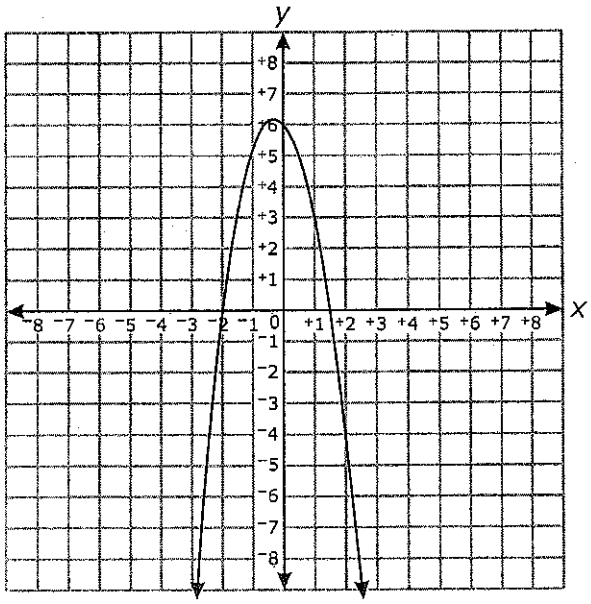
Answer choices C and D are on the following page.

Go to the next page.

C


y
x
+8
+7
+6
+5
+4
+3
+2
+1
-8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8
-1
-2
-3
-4
-5
-6
-7
-8

D


y
x
+8
+7
+6
+5
+4
+3
+2
+1
-8 -7 -6 -5 -4 -3 -2 -1 0 +1 +2 +3 +4 +5 +6 +7 +8
-1
-2
-3
-4
-5
-6
-7
-8

8 The sum of two numbers is 24. The sum of the squares of the two numbers is 306. What is the product of the two numbers?

A 119

B 128

C 135

D 144

$x + y = 24 \longrightarrow x = 24 - y$ (solve & substitute)

$x^2 + y^2 = 306$

Box or FOIL $(24-y)(24-y) + y^2 = 306$

$576 - 48y + y^2 + y^2 = 306$

$-576 \quad -576$

$-48y + 2y^2 = -270$

$2y^2 - 48y + 270 = 0$

$2(y^2 - 24y + 135) = 0$

$2(y - 15)(y - 9) = 0$

$y = 15 \text{ & } 9$

$15 \times 9 = 135$

9 Which equation has exactly one real solution?

A $4x^2 - 12x - 9 = 0$

B $4x^2 + 12x + 9 = 0$

C $4x^2 - 6x - 9 = 0$

D $4x^2 + 6x + 9 = 0$

$b^2 - 4ac$

$(12)^2 - 4(4)(9)$

$144 - 144$

$= 0$

* Notes: $b^2 - 4ac$ (Discriminant)

$-$ = 0 reals w/ 2 imaginary solutions

$+$ = 2 real solutions

0 = 1 real solution

10 A circular pond is modeled by the equation $x^2 + y^2 = 225$. A bridge over the pond is modeled by a segment of the equation $x - 7y = -75$. What are the coordinates of the points where the bridge meets the edge of the pond?

A (9, 12) and (−12, 9)

B (9, 12) and (12, 9)

C (9, −12) and (−12, −9)

D (−9, 12) and (12, −9)

CIRCLE $(x-h)^2 + (y-k)^2 = r^2$

(h, k) = center

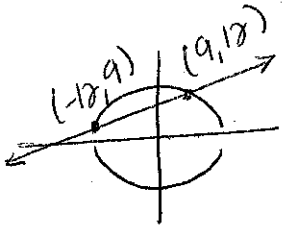
r = radius

$x^2 + y^2 = 225$

$(x-0)^2 + (y-0)^2 = 15^2$

$C(0,0)$ $R = 15$

* Remember when you take the $\sqrt{}$ you get a $\pm$!



$x^2 + y^2 = 225 - x^2$

$7y^2 = 225 - x^2$

$y = \pm\sqrt{225 - x^2}$

Solve for y & graph.

$x - 7y = -75 - x$

$-7 \quad -7$

$y = 1/7x + 75/7$

Go to the next page.

11 The volume, V, of a certain gas varies inversely with the amount of pressure, P, placed on it. The volume of this gas is 175 cm^3 when 3.2 kg/cm^2 of pressure is placed on it. What amount of pressure must be placed on 400 cm^3 of this gas?

A 1.31 kg/cm^2

B 1.40 kg/cm^2

C 2.86 kg/cm^2

D 7.31 kg/cm^2

$x_1y_1 = x_2y_2$

$(3.2)(175) = (x)(400)$

$400x = 560$

$\frac{400}{400}$

$x = 1.4$

12 A company manufactures DVDs.

- The company spent \$247,000 to develop its process for manufacturing the DVDs.
- The company spends an additional \$1.25 to manufacture each DVD.

Which function represents the average total cost per DVD, y, for the company to manufacture x total DVDs?

A $y = \frac{x}{1.25x}$

B $y = \frac{1.25x}{x}$

C $y = \frac{x}{1.25x + 247,000}$

D $y = \frac{1.25x + 247,000}{x}$

For example - 10 DVDs

$\frac{247,000 + 1.25(10)}{10}$

Go to the next page.

20B 80R

13 For a carnival game, a jar contains 20 blue marbles and 80 red marbles. 100 total marbles

- Children take turns randomly selecting a marble from the jar.
- If a blue marble is chosen, the child wins a prize.
- After each turn, the marble is replaced. (Independent)
- Casey has drawn six red marbles in a row.

Which statement is true?

A If Casey selects another red marble, then 2 of her next 3 picks will be blue marbles because 2 blue marbles are selected for every 8 red marbles selected.

~~B~~ The probability that Casey selects a blue marble on the next turn is higher than it was on her last turn because she has chosen so many red marbles in a row.

C The probability that Casey selects a blue marble on her next turn is the same as it was on the last turn because selections are independent of each other.

D If Casey draws 4 more times, she will select 2 blue marbles because the probability that a blue marble will be selected is 2 out of every 10 turns.

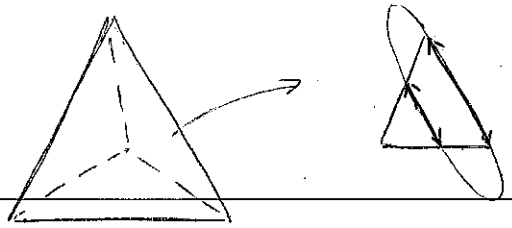
14 A plane intersects a regular triangular pyramid. The plane is parallel to one of the faces of the pyramid. What type of polygon is formed at the intersection?

~~A~~ square

~~B~~ right triangle

C isosceles trapezoid

D isosceles triangle



15 The number of bacteria in a culture can be modeled by the function $N(t) = 28t^2 - 30t + 160$, where t is the temperature, in degrees Celsius, the culture is being kept. A scientist wants to have fewer than 200 bacteria in a culture in order to test a medicine effectively. What is the ***approximate*** domain of temperatures that will keep the number of bacteria under 200?

A $-1.01°C < t < 2.03°C$ $28(-1.01)^2 - 30(-1.01) + 160 = 218$

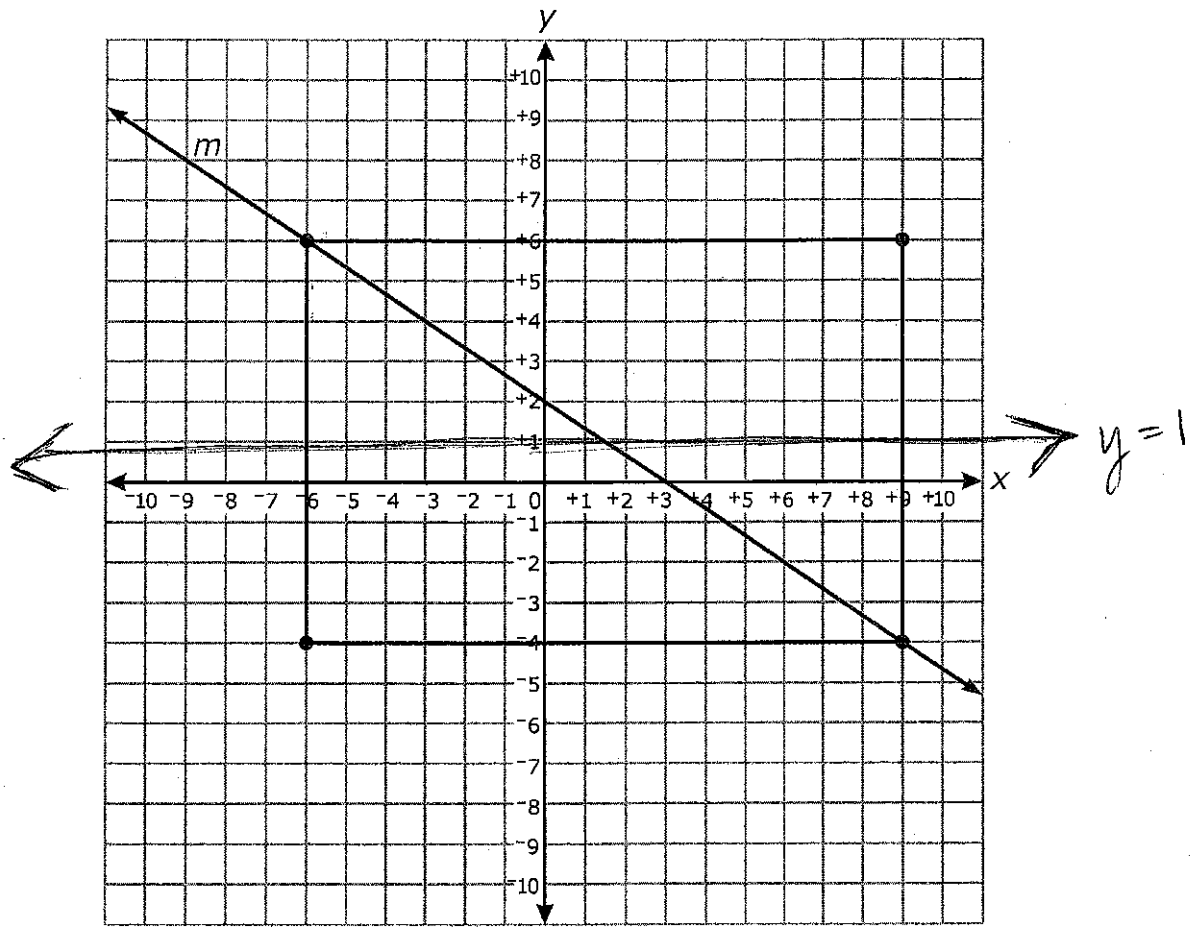
B $-0.90°C < t < 1.97°C$ $28(-.9)^2 - 30(-.9) + 160 = 209$

C $-0.86°C < t < 1.93°C$ $28(-.86)^2 - 30(-.86) + 160 = 207$

D $-0.77°C < t < 1.85°C$ $28(-.77)^2 - 30(-.77) + 160 = 199$

Go to the next page.

17 Which transformation will carry the rectangle shown below onto itself?



A a reflection over line m

B a reflection over the line $y = 1$

C a rotation 90° counterclockwise about the origin

D a rotation 270° counterclockwise about the origin

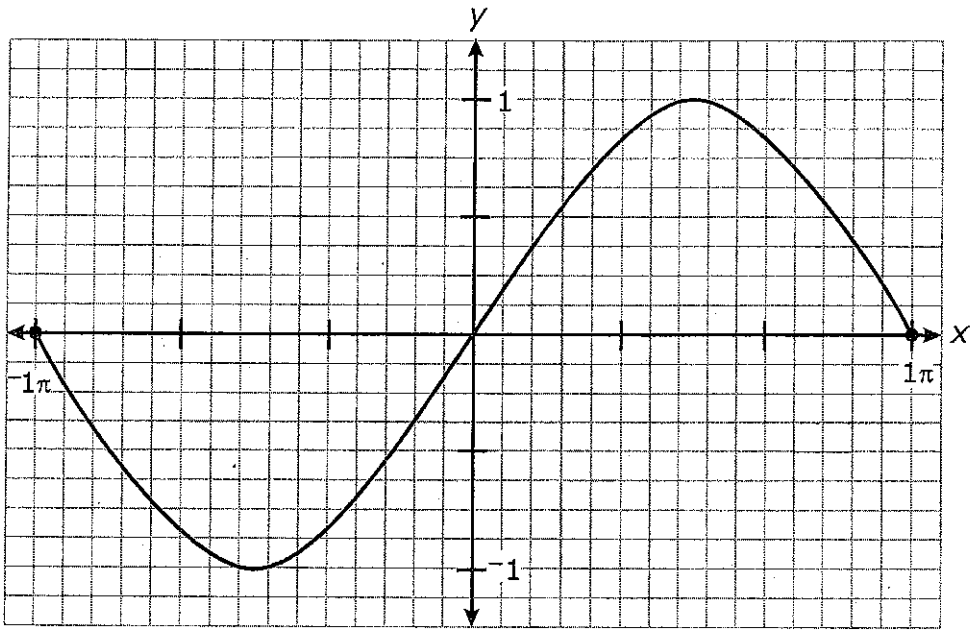
$(9,6) \rightarrow (-6,9)$

$(-y,x)$

$(y,-x)$ $(9,6) \rightarrow (6,-9)$

Go to the next page.

16 Which function is graphed below?



(A) $y = \sin x$

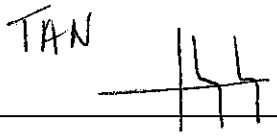
B $y = \cos x$

C $y = \tan x$

D $y = \cot x$

ZOOM TRIG

calculator in radians for graphing trig functions!



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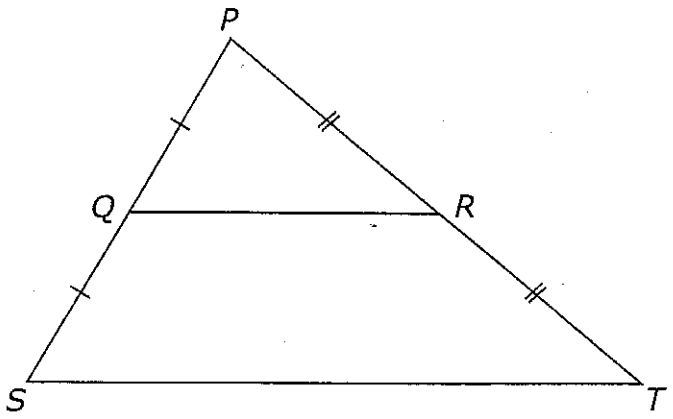
18 Which statement must be true about the triangle below?



A $PQ + QS = PR + RT$

B $\triangle PQR \cong \triangle PST$

C $ST = 2 \cdot QR$ (Δ Midsegment Theorem)

D $\angle S \cong \angle T$

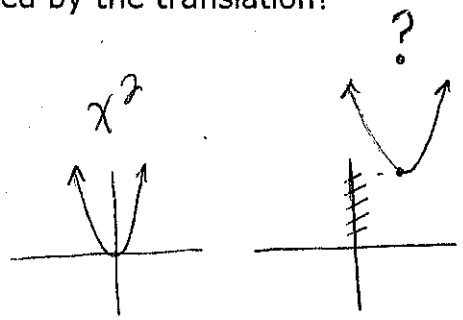
19 The graph of $f(x) = x^2$ will be translated 5 units up and 2 units to the right. Which function describes the graph produced by the translation?

A $g(x) = x^2 - 4x + 9$

B $g(x) = x^2 + 4x - 1$

C $g(x) = x^2 - 10x + 27$

D $g(x) = x^2 + 10x + 23$



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20 An investment has a balance of $2,000 and earns 3.2% interest each year. If $150 is added at the end of each year by the account holder and no money is withdrawn from the investment, which represents a function that can be used to calculate the investment balance for successive years?

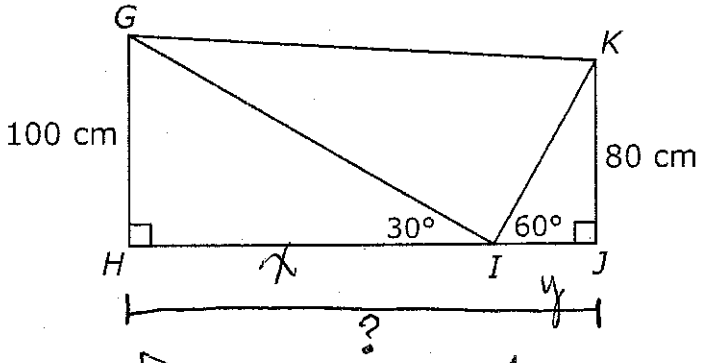
A $B_n = 0.032B_{n-1} + 2{,}000,\ B_0 = 150$

B $B_n = 0.032B_{n-1} + 150,\ B_0 = 2{,}000$

C $B_n = 1.032B_{n-1} + 2{,}000,\ B_0 = 150$

D $B_n = 1.032B_{n-1} + 150,\ B_0 = 2{,}000$

21 What is the ***approximate*** length of $\overline{HJ}$ in the diagram below?

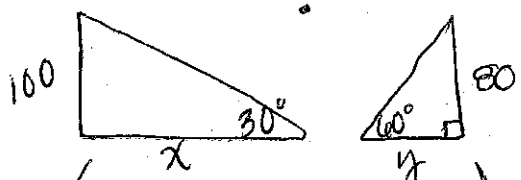


A 292 cm

B 265 cm

C 219 cm

D 196 cm



$x + y = HJ$

$\tan 30 = \frac{100}{x}$ $\tan 60 = \frac{80}{y}$

$\frac{100}{\tan 30}$ $\frac{80}{\tan 60}$

$x = 173.2$ + $y = 46.2$

$HJ = 219.4$

SOH CAH TOA

* Must use law of sines/cosines for non rt. Δ's.

Go to the next page.

22 Angles F and G are complementary angles.

- As the measure of angle F varies from a value of x to a value of y, $\sin(F)$ increases by 0.2.

How does $\cos(G)$ change as F varies from x to y?

A It increases by a greater amount.

B It increases by the same amount.

C It increases by a lesser amount.

D It does not change.

$F + G = 90$
sin & cos are cofunctions

23 If t is an unknown constant, which binomial must be a factor of $7m^2 + 14m - tm - 2t$?

A $7m + t$

B $m - t$

C $m + 2$

D $m - 2$

$(7m - t)(m + 2)$
✓ using FOIL/Box

	$7m$	$-t$
m	$7m^2$	$-tm$
2	$14m$	$-2t$

24 The value, V, of a car can be modeled by the function $V(t) = 13{,}000(0.82)^t$, where t is the number of years since the car was purchased. To the nearest tenth of a percent, what is the monthly rate of depreciation?

A 1.5%

B 1.6%

C 9.2%

D 18.0%

$100\% - 82\% = 18\%$
$\frac{18\%}{12} = 1.5\%$

Go to the next page.

25 Which expression is equivalent to $\left(\frac{16x^{\frac{1}{6}}y^{-2}}{x^{-\frac{1}{6}}y^{6}}\right)^{\frac{3}{2}}$?

* when dividing / subtract exp.

* exp. power / multiply

$1/6 + 1/6$

$2/6 = 1/3$

$-2-6 = -8$

$1/3 \cdot 3/2 = 3/6 = 1/2$

$-8 \cdot \frac{3}{2} = \frac{-24}{2} = -12$

$(16^{1}x^{1/3}y^{-8})^{3/2}$ (x)

$16^{3/2}x^{1/2}y^{-12}$

$64x^{1/2}$

y^{12}

A $24x^{\frac{9}{2}}y^{\frac{9}{2}}$

B $\frac{24x^{\frac{3}{4}}}{y^{9}}$

C $\frac{64}{x^{\frac{1}{2}}y^{8}}$

D $\frac{64x^{\frac{1}{2}}}{y^{12}}$

This is the end of the multiple-choice portion of the test.

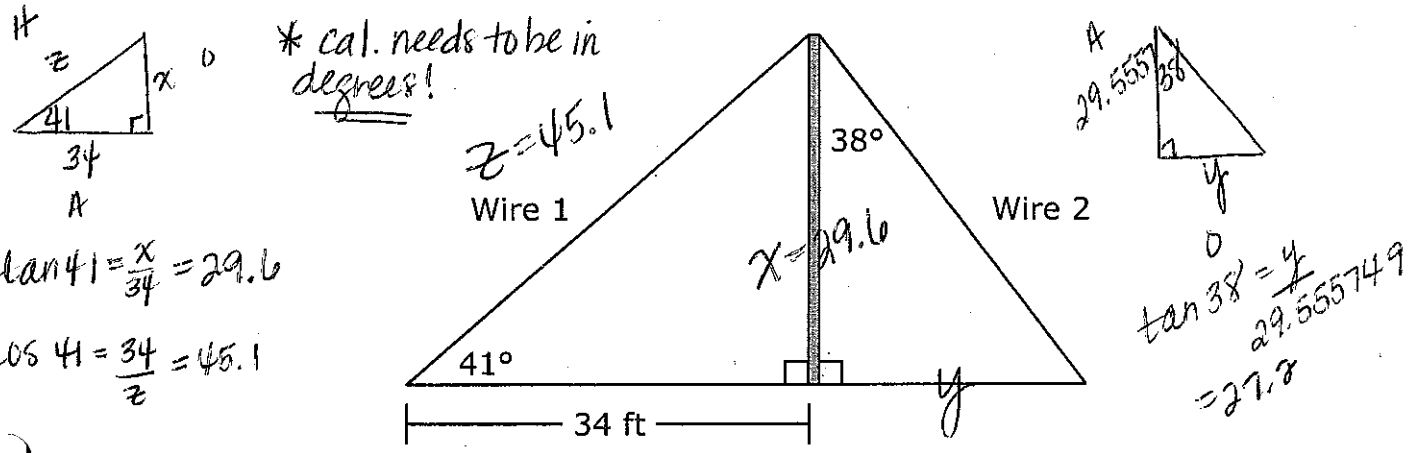
Go to the next page.

The questions you read next will require you to answer in writing.

1. **Write your answers on separate paper.**
2. **Be sure to write your name on each page.**

** Remember for constructed response it's important to show all work b/c teachers will be grading & can give ½ credit! Try something - write something!

1 In the figure below, a pole has two wires attached to it, one on each side, forming two right triangles.



* cal. needs to be in degrees!

$z = 45.1$

$x = 29.6$

$\tan 41 = \frac{x}{34} = 29.6$

$\cos 41 = \frac{34}{z} = 45.1$

$\tan 38 = \frac{y}{29.555749}$

$= 27.8$

Based on the given information, answer the questions below.

- How tall is the pole? 29.6
- How far from the base of the pole does Wire 2 attach to the ground? 27.8
- How long is Wire 1? 45.1

2 The amount of time it takes to build a road varies inversely with the number of workers building the road. Suppose it takes 50 workers 8 months to build the road.

- What is the constant of variation? $t = \#/w$ $8 = \#/50$ $\# = 400$
- Write an equation that could be used to determine how long it would take *n* workers to build the road. (Be sure to define the variables.) $t = \frac{400}{n}$
- How much faster would 60 workers build the road than 50 workers? $\frac{400}{60} = (6.6 \text{ mths})$ $\frac{400}{50} = (8 \text{ mths})$ * about a month & a half (1.4)

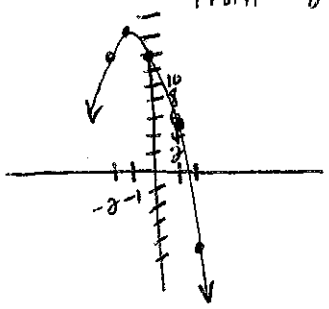
Go to the next page.

3 The function $f(x)$ is defined as $f(x) = x^2 + 2x - 4$. The function $g(x)$ is defined as $g(x) = {}^-3f(x) + 2$.

- Graph $g(x)$ for ${}^-2 \le x \le 2$.
- Describe the transformations that take the function $f(x)$ onto $g(x)$.
- Write a new function, $h(x)$, that transforms $g(x)$ back onto $f(x)$.

$g(x): -3(x^2+2x-4)+2$ (Graph & look @ table from -2 to 2)

x	y
-2	14
-1	17
0	14
1	5
2	-10



The g(x) function gets flipped upside down & gets wider because of the -3. Then the function gets raised 2 units.

$g(x): \dfrac{-3x^2-6x+14(-2)}{(-3)} \rightarrow \dfrac{-3x^2}{-3} - \dfrac{6x}{-3} + \dfrac{12}{-3}$

$\boxed{h(x) = x^2+2x-4}$

Go to the next page.