The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA 2/ TRIGONOMETRY

Wednesday, January 25, 2017 — 1:15 – 4:15 p.m.

SAMPLE RESPONSE SET

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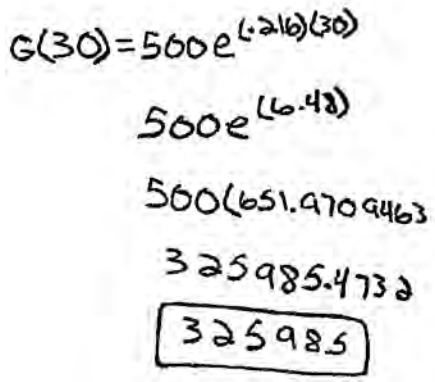
Question 28

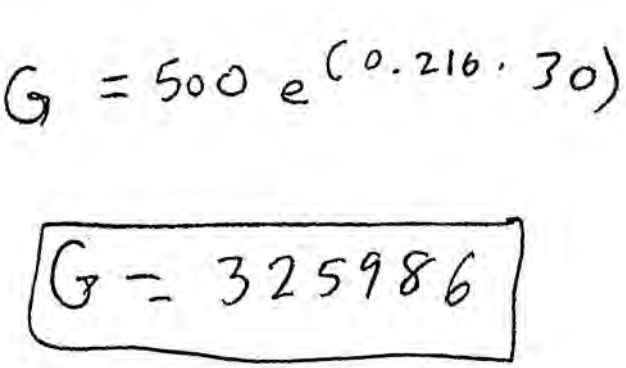
28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.



Score 2: The student gave a complete and correct response.

Question 28

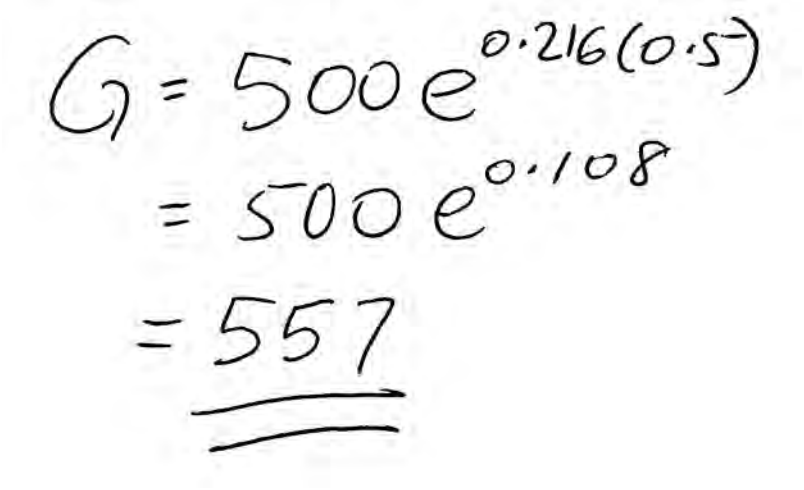
28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.



Score 1: The student made a rounding error.

Question 28

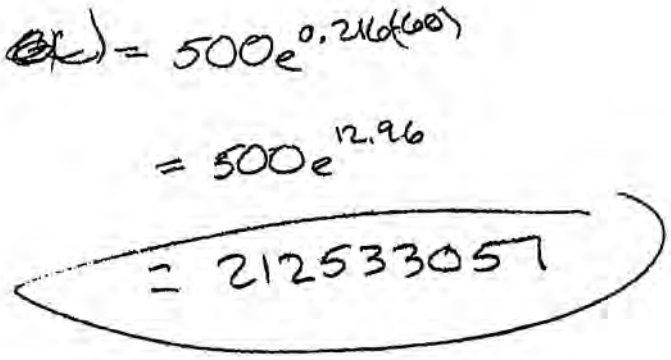
28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.



Score 1: The student made an error by using 0.5.

Question 28

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.



Score 1: The student made an error by using 60 minutes.

Question 28

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$G(30) = 500e^{.216 \times 30}$

$= 18616.5$

$= 18617$

Score 1: The student correctly substituted into the function, but did not use 30 as an exponent.

Question 28

28 The number of bacteria that grow in a petri dish is approximated by the function $G(t) = 500e^{0.216t}$, where t is time, in minutes. Use this model to approximate, to the *nearest integer*, the number of bacteria present after one half-hour.

$G(30) = 500e^{.216(30)}$

$\frac{G(30)}{30}$ $\frac{325985.4731}{30}$

$G = 10866.18244$

Score 0: The student made an error by dividing by 30 and did not round properly.

Question 29

29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$$\frac{1}{\left(\frac{27}{64}\right)^{2/3}} = \frac{1}{9/16} = \frac{16}{9}$$

Score 2: The student gave a complete and correct response.

Question 29

29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

Score 2: The student gave a complete and correct response.

Question 29

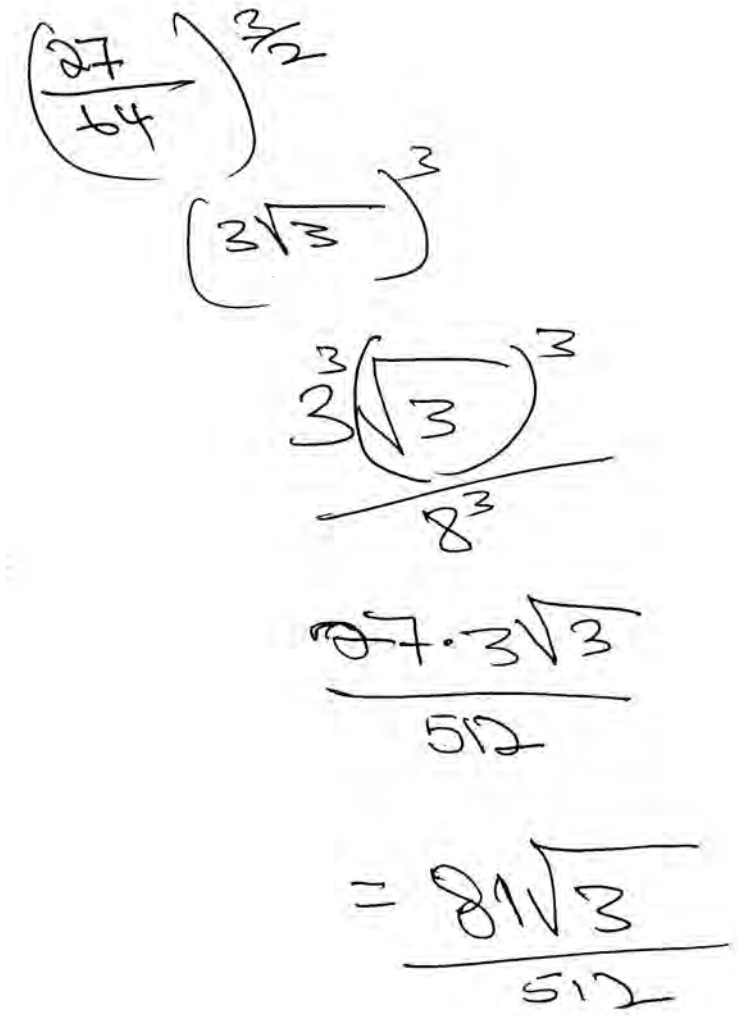
29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.

$\left(\frac{27}{64}\right)^{-2/3} = \left(\frac{64}{27}\right)^{2/3} = \left(\sqrt[3]{\frac{64}{27}}\right)^2 = \left(\frac{4}{3}\right)^2 = \frac{16}{9}$

Score 2: The student gave a complete and correct response.

Question 29

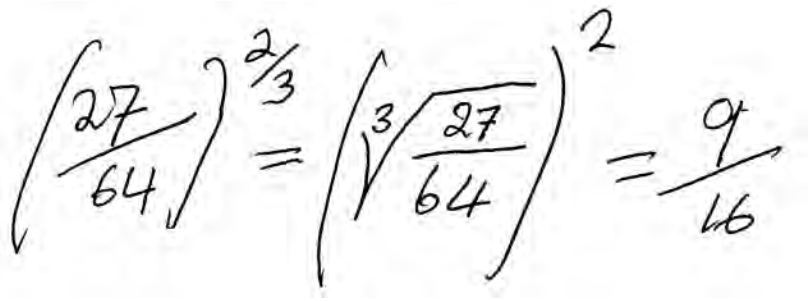
29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.



Score 1: The student made an error by using the negative reciprocal of $-\frac{2}{3}$.

Question 29

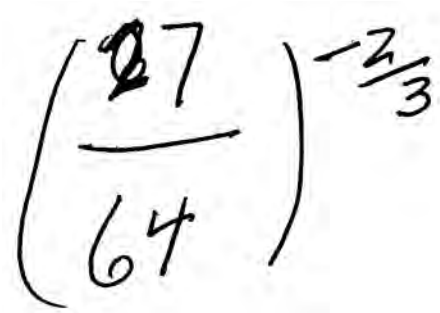
29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.



Score 1: The student made a transcription error by not writing $-\frac{2}{3}$.

Question 29

29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.



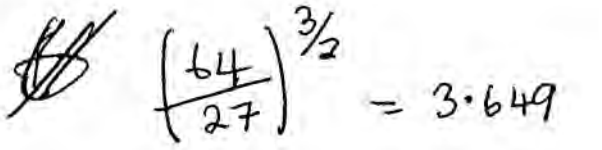
$$\left(\frac{27}{64}\right)^{-\frac{2}{3}}$$

$$(0.421875)^{-\frac{2}{3}} = 1.\overline{7}$$

Score 1: The student did not write the answer in fraction form.

Question 29

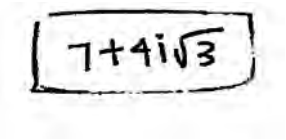
29 Determine the exact value of $\left(\frac{27}{64}\right)^{-\frac{2}{3}}$ as a fraction in simplest form.



Score 0: The student made an error by using the negative reciprocal of the exponent and expressed the answer as a decimal.

Question 30

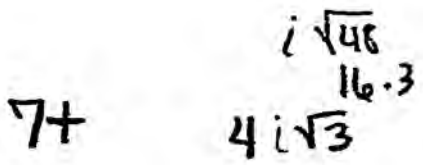
30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

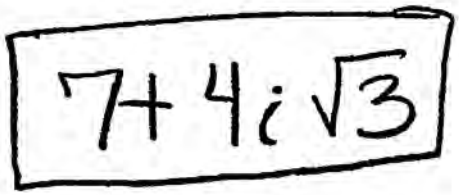


Score 2: The student gave a complete and correct response.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

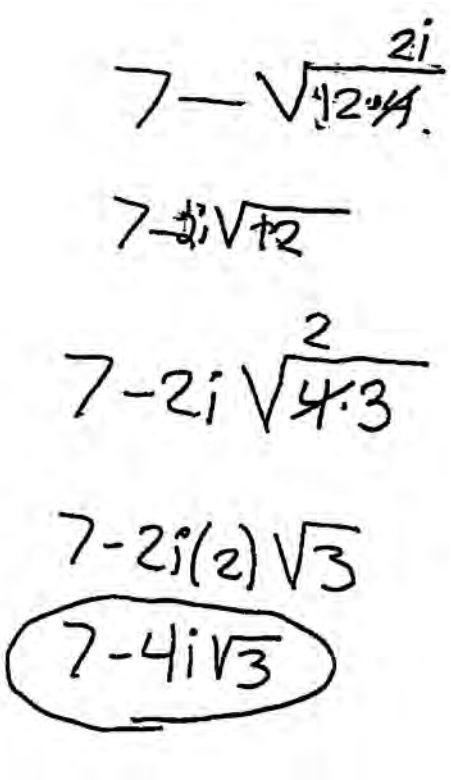




Score 2: The student gave a complete and correct response.

Question 30

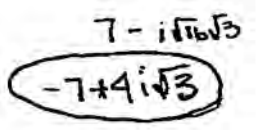
30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.



Score 1: The student wrote $7 - \sqrt{-48}$ in simplest $a + bi$ form, but did not state the conjugate.

Question 30

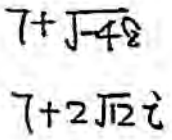
30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.



Score 1: The student wrote the additive inverse of $7 - \sqrt{-48}$ in simplest $a + bi$ form, not the conjugate.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.



Score 1: The student stated the conjugate correctly, but did not express it in simplest form.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.

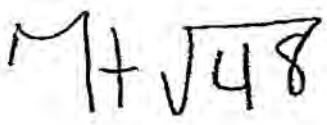
$$\frac{1}{7-\sqrt{-48}} \cdot \frac{7+\sqrt{-48}}{7+\sqrt{-48}}$$

$$\frac{1}{7-i\sqrt{48}} \cdot \frac{7+i\sqrt{48}}{7+i\sqrt{48}} = \frac{7+i\sqrt{48}}{97} = \frac{7+4i\sqrt{3}}{97}$$

Score 1: The student found the multiplicative inverse of $7-\sqrt{-48}$.

Question 30

30 State the conjugate of $7 - \sqrt{-48}$ expressed in simplest $a + bi$ form.



Score 0: The student gave a completely incorrect response.

Question 31

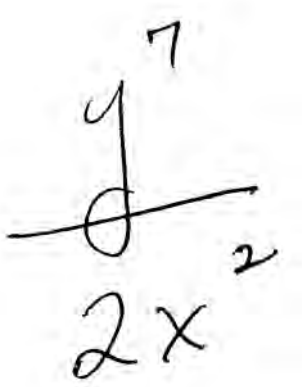
31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

$$\frac{12x^3y^2y^5}{24x^5} = \frac{y^7}{2x^2}$$

Score 2: The student gave a complete and correct response.

Question 31

31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.



Score 2: The student gave a complete and correct response.

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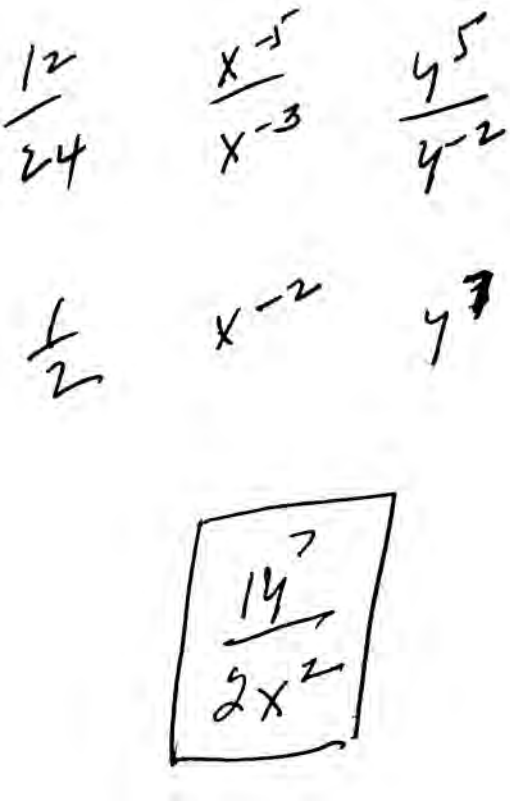
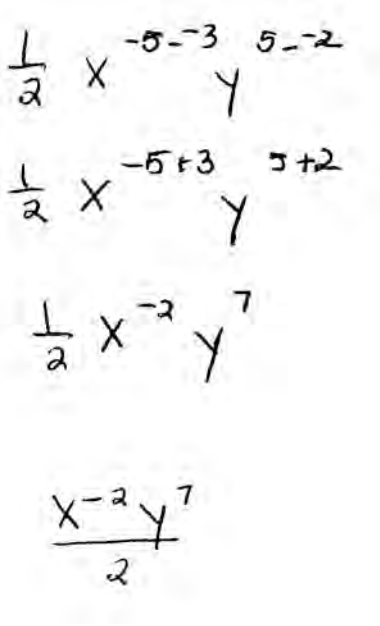
31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.



Score 2: The student gave a complete and correct response.

Question 31

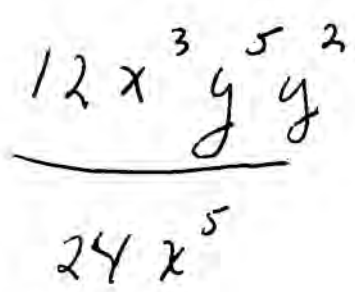
31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

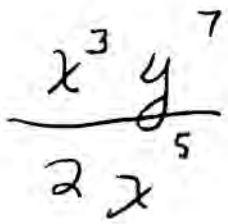


Score 1: The student did not express the answer using only positive exponents.

Question 31

31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.

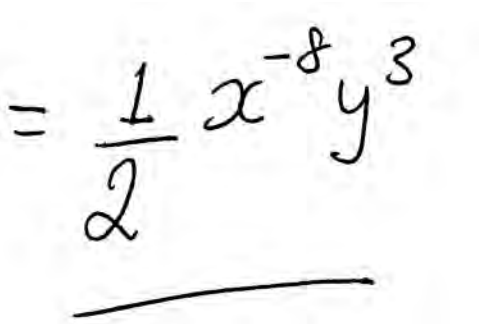




Score 1: The student did not simplify completely.

Question 31

31 Express $\frac{12x^{-5}y^{5}}{24x^{-3}y^{-2}}$ in simplest form, using only positive exponents.



Score 0: The student added exponents and did not express the answer using only positive exponents.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$S_n = \frac{n(a_1 + a_n)}{2}$

$S_n = \frac{30(15 + 73)}{2}$

$S_n = \frac{30(88)}{2}$

$S_n = 1320$

$a_n = a + d(n-1)$

$a_n = 15 + 2(30-1)$

$a_n = 15 + 2(29)$

$a_n = 73$

Score 2: The student gave a complete and correct response.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$$S_n = \frac{n(2a_1 + (n-1)d)}{2}$$

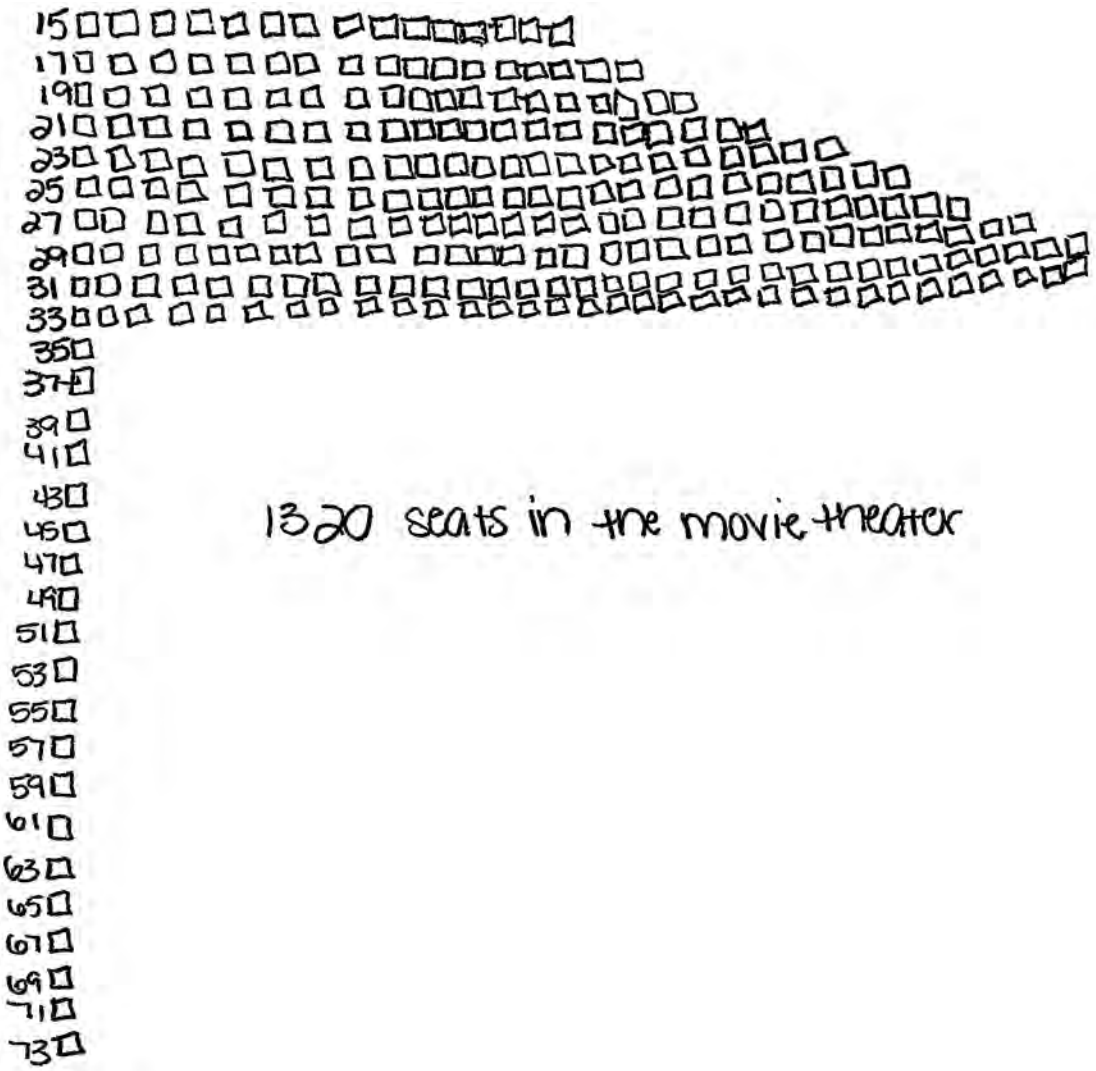
$$S_{30} = \frac{30(2(15) + 29(2))}{2}$$

$$S_{30} = 1320$$

Score 2: The student gave a complete and correct response.

Question 32

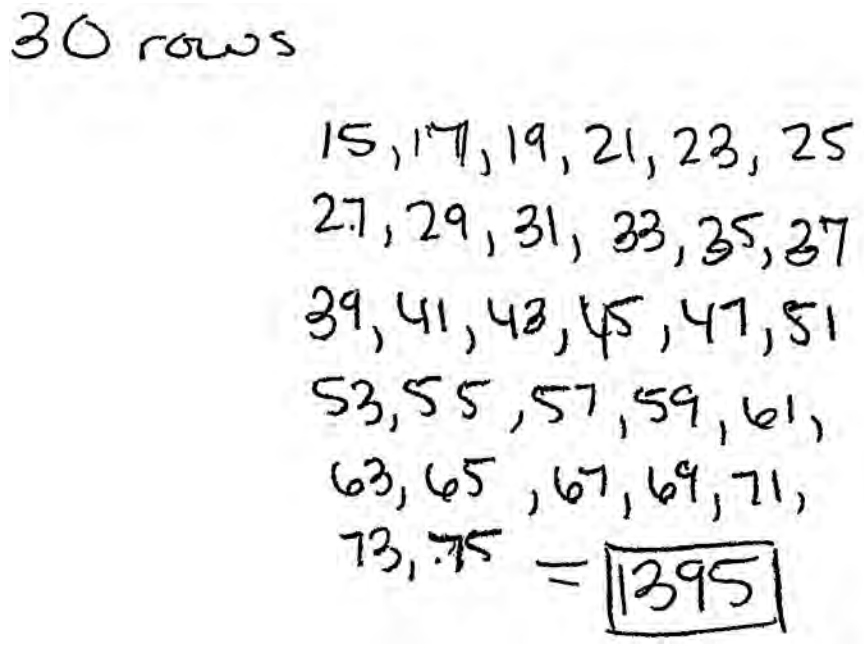
32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.



Score 2: The student gave a complete and correct response.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.



Score 1: The student did not list 49, but used it to find the sum, plus the 75.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.

$S_n = \frac{n(a_1 + a_n)}{2}$

$S_n = \frac{30(15+30)}{2}$

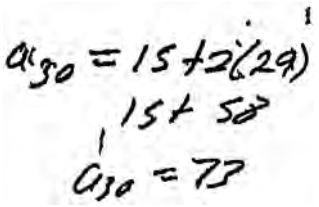
$S_n = \frac{1350}{2}$

$S_n = 675$ seats

Score 1: The student used 30 rows instead of 73 seats in row 30 when using the formula.

Question 32

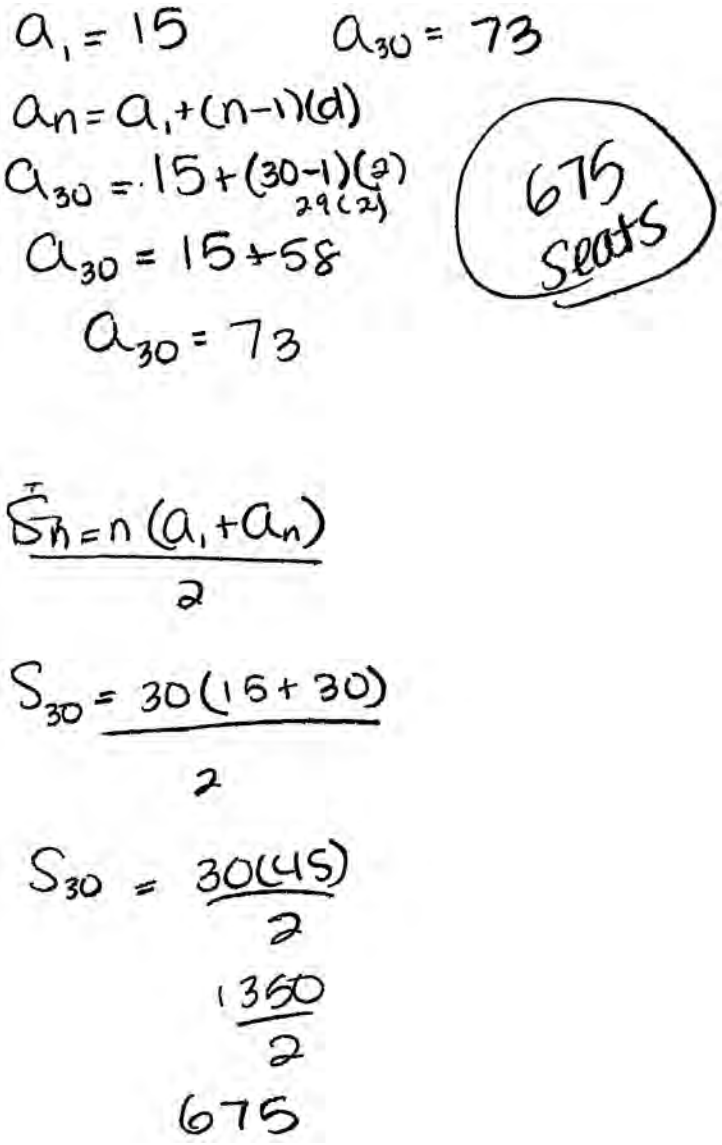
32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.



Score 1: The student calculated the number of seats in the last row, but did not calculate the total seating capacity.

Question 32

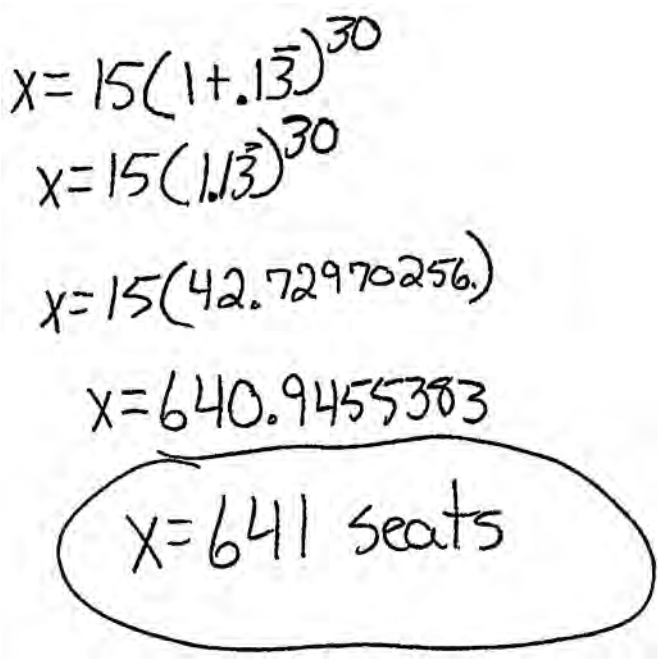
32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.



Score 1: The student calculated 73, the number of seats in row, 30, but used the 30 in the formula.

Question 32

32 In a theater with 30 rows, the number of seats in a row increases by two with each successive row. The front row has 15 seats. Find the total seating capacity of the theater.



Score 0: The student gave a completely incorrect response.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

$x+2 \rightarrow f \rightarrow g$

$f(x) = x^2$

$f(x+2) = (x+2)(x+2)$

$= x^2 + 4x + 4$

$x^2 + 4x + 4 - 3$

$\boxed{x^2 + 4x + 1}$

Score 2: The student gave a complete and correct response.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

$f(x+2) = (x+2)^2$

$g(x+2)^2 = (x+2)^2 - 3$

$(x+2)(x+2) - 3$

$x^2 + 4x + 4 - 3$

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

Score 2: The student gave a complete and correct response.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

$(x+2)^2 - 3$

$(x+2)(x+2)$

$x^2 + 2x + 2x + 4 - 3$

$(x^2 + 4x + 4) - 3$

$g(f(x+2)) = (x+2)(x+2) - 3$

$g(f(x+2)) = (x^2 + 4x + 4) - 3$

Score 1: The student did not express the answer in simplest form.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

$f(x+2) = (x+2)^2$

$= x^2 + 4$

$g(x^2+4) = x^2+4-3$

$= x^2 + 1$

Score 1: The student made an error when squaring $x + 2$.

Question 33

33 Given $f(x) = x^2$ and $g(x) = x - 3$, express $g(f(x + 2))$ as a polynomial in simplest form.

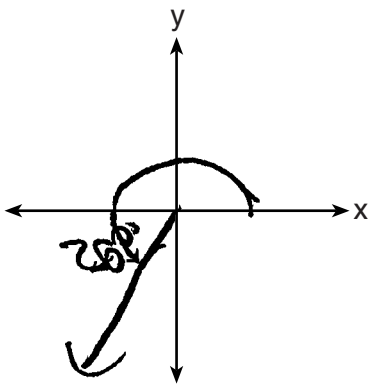
$g(x+2) = x+2-3 = x-1$

$f(x-1)^2 = x^2-1$

Score 0: The student evaluated the expression from left to right and made an error squaring $x - 1$.

Question 34

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.

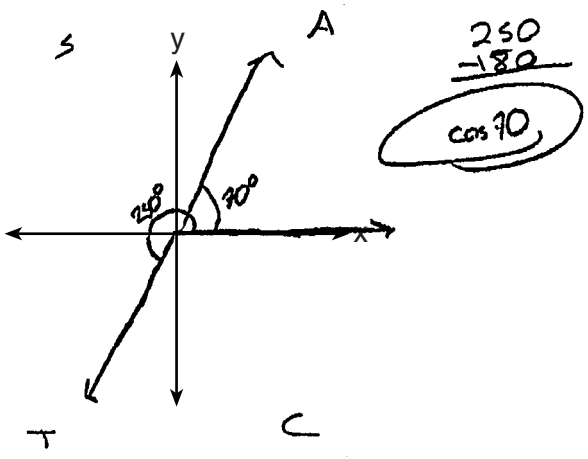


$\cos 250 = -\cos 70$

Score 2: The student gave a complete and correct response.

Question 34

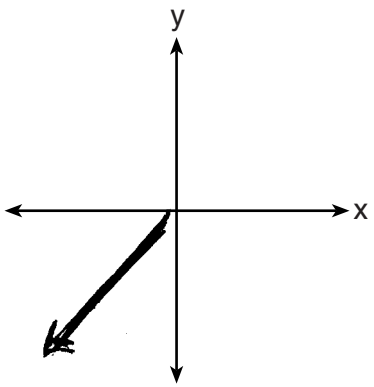
34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.



Score 1: The student sketched the angle correctly, but did not state −cos 70.

Question 34

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.

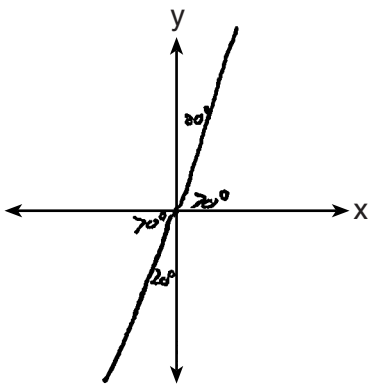


$-\cos 70$

Score 1: The student did not indicate the direction of rotation.

Question 34

34 Sketch an angle of 250° in standard position and then express cos 250° as a cosine function of a positive acute angle.



$\cos 250° = \cos 70°$

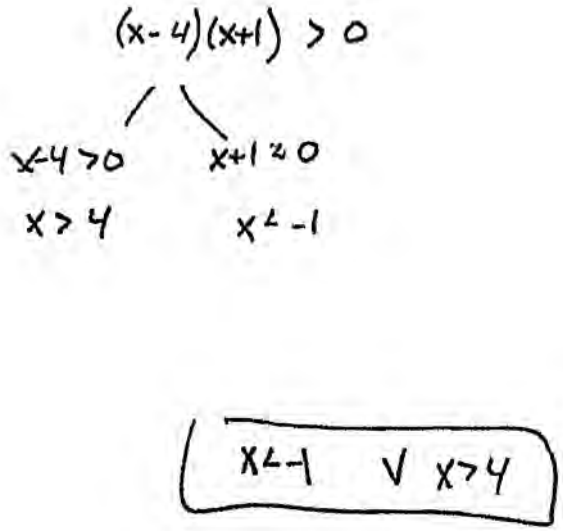
$250 - 180 = 70°$

QIII = ∠ − 180

Score 0: The student did not indicate the 250° angle and stated an incorrect sign for the function.

Question 35

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.



Score 2: The student gave a complete and correct response.

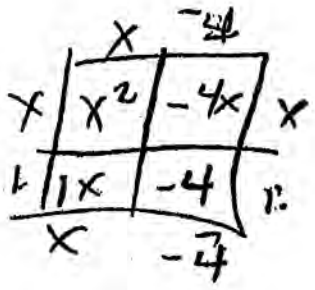
Question 35

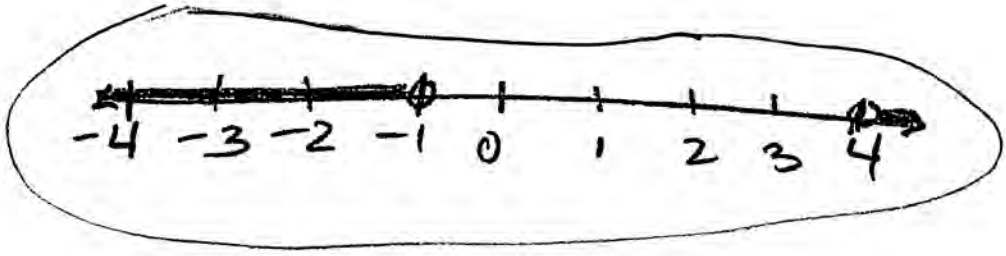
35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

$x^2 - 3x - 4 = 0$

$(x - 4)(x + 1) = 0$

$x = 4$ or $x = -1$

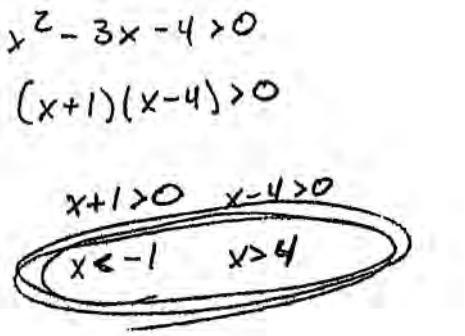




Score 2: The student gave a complete and correct response.

Question 35

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.



Score 1: The student did not state the solution as a disjunction.

Question 35

35 Solve the inequality $x^2 - 3x - 4 > 0$ algebraically for x.

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-4)}}{2(1)}$

$x = \frac{3 \pm \sqrt{9 + 16}}{2}$

$x = \frac{3 \pm \sqrt{25}}{2}$

$x = \frac{3 \pm 5}{2}$

$x = \frac{3+5}{2} = 4$

$x = \frac{3-5}{2} = -1$

$(x-4)(x+1)$

$x - 4 = 0 \quad x + 1 = 0$

$x = 4 \quad x = -1$

Score 0: The student solved the equation $x^2 - 3x - 4 = 0$, but did nothing with the inequality.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

$y = .098x + .402$

State the strength and direction indicated by the correlation coefficient.

high positive correlation

Score 4: The student gave a complete and correct response.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005
Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

linear regression → $y = .098x + .402$

State the strength and direction indicated by the correlation coefficient.

The correlation coefficient was .988 so it is pretty strong because it is closer to the points and +1 and not zero which means that the points are graphed in a direct relationship: as the years increase so does the minimum wage.

Score 4: The student gave a complete and correct response.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

$Y = .098x + .402$

State the strength and direction indicated by the correlation coefficient.

• The direction is positive and the strength is 0.988.

Score 3: The student did not state the strength of the correlation coefficient appropriately.

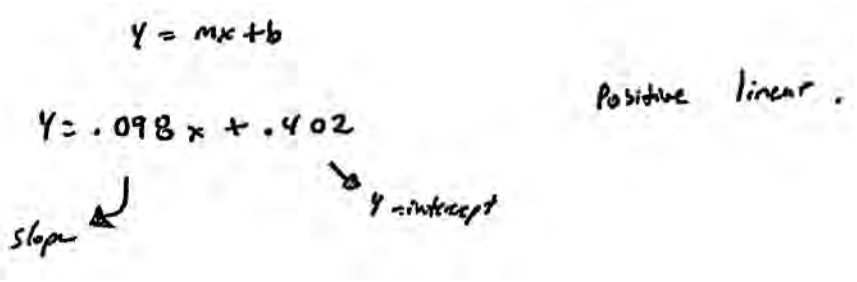
Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.



Score 3: The student did not state the strength of the correlation coefficient.

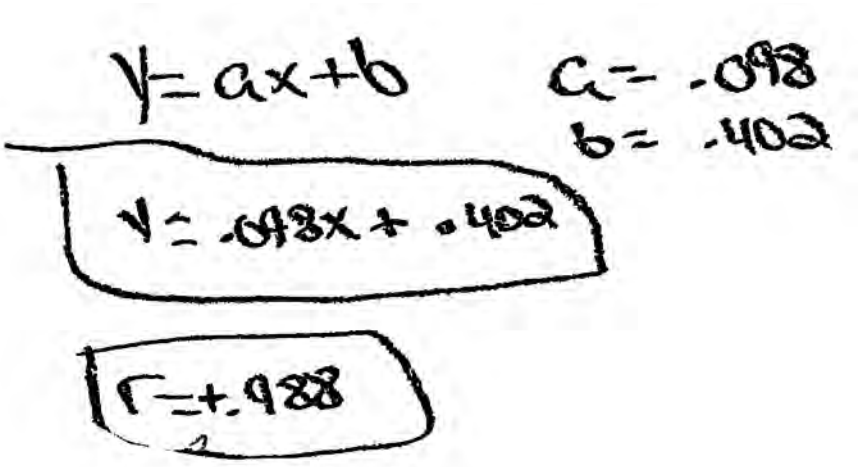
Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.



Score 3: The student wrote a correct regression equation and indicated the direction when writing the correlation coefficient, but did not write the strength.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = 0.0975454545x + .4022727273$

$y = 0.098x + 0.402$

The strength the very low and increases at a rate of 0.098 per 5 years

Score 2: The student wrote a correct regression, but described the slope instead of the correlation coefficient.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

.402 + .098x

State the strength and direction indicated by the correlation coefficient.

r = +.9876

Score 2: The student wrote an expression and indicated a positive correlation.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

$y = ax + b$

$a = .098$

$b = .402$

Score 2: The student wrote a correct regression equation.

Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.

LinReg

$y = ax + b$

$y = .0975x + 0.4022$

strength = 0.9875

Score 1: The student did not round correctly, and did not state the strength and the direction of the correlation coefficient.

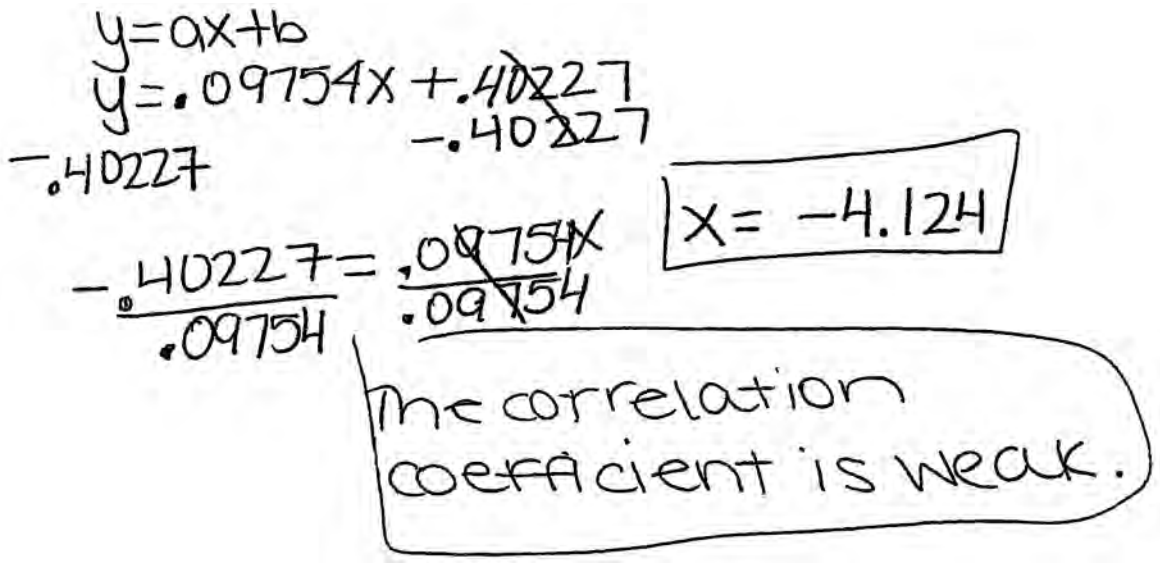
Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.



Score 1: The student did not round the regression equation correctly and stated the wrong strength and no direction.

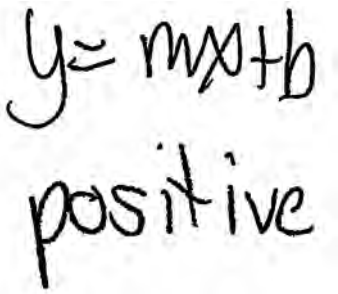
Question 36

36 The table below shows the minimum hourly wage, in U.S. dollars, for selected years since 1955.

Years Since 1955 (x)	0	5	10	15	20	25	30	35	40	45	50
Minimum Wage (y)	.75	1.00	1.25	1.45	2.00	3.10	3.35	3.80	4.25	5.15	5.15

Write the linear regression equation for this set of data, rounding all values to *three decimal places.*

State the strength and direction indicated by the correlation coefficient.



Score 0: The student stated strong positive, but gave no supporting evidence.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$

$y = x - 2$

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

$2x - 4 = x^2 - 3x$

$x^2 - 5x + 4 = 0$

$(x-4)(x-1) = 0$

$x = 4 \quad x = 1$

$y \pm 2 = 4$ $\quad y + 2 = 1$

$y = 2$ $\quad y = -1$

Solutions

$(4, 2)$

$(1, -1)$

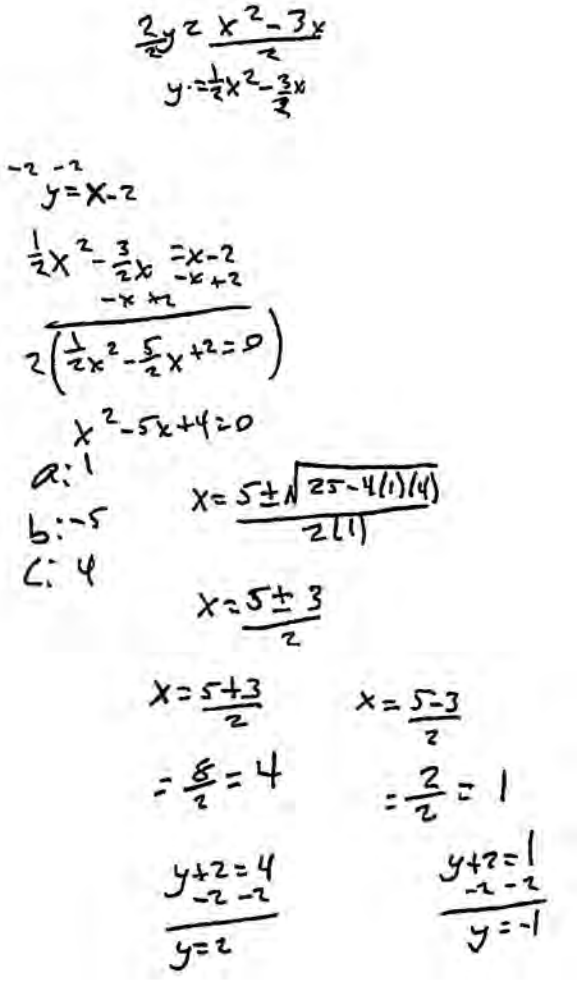
Score 4: The student gave a complete and correct response.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$



Score 4: The student gave a complete and correct response. The student clearly indicated which x-value was used to obtain the y-value.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$

$$\frac{y}{y+2} = \frac{y+2-3}{2}$$

$$\frac{y}{y+2} = \frac{y-1}{2}$$

$$2y = y^2 + y - 2$$

$$0 = y^2 - y - 2$$

$$(y-2)(y+1) = 0$$

$y = 2$ | $y = -1$

$x = 4$ | $x = 1$

Score 4: The student gave a complete and correct response.

Question 37

37 Solve the system of equations algebraically for x and y:

$\frac{y}{x} = \frac{x-3}{2}$

$y + 2 = x$

$\frac{-1}{1} = \frac{1-3}{2}$

$\frac{y}{y+2} = \frac{(y+2)-3}{2}$

$\frac{-1}{1} = \frac{-2}{2}$

$-2 = -2$

$x = 0$

-1

$x = 1$

$2y = (y+2)(y-1)$

$2y = y^2 + y - 2$

$-2y \quad -2y$

$0 = y^2 - y - 2$

$(y-2)(y+1) = 0$

$y - 2 = 0$

$y = +2$

$y + 1 = 0$

$-1 \quad -1$

$y = -1$

$y = -1 \quad x = 1$

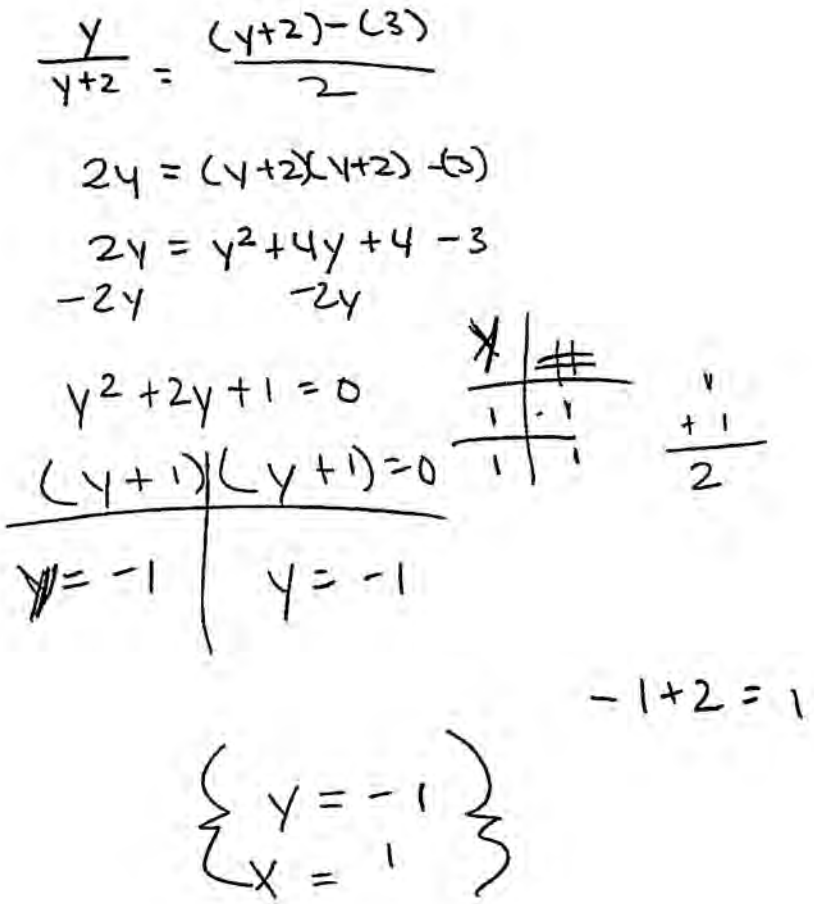
Score 3: The student found both y-values, but only one x-value.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$



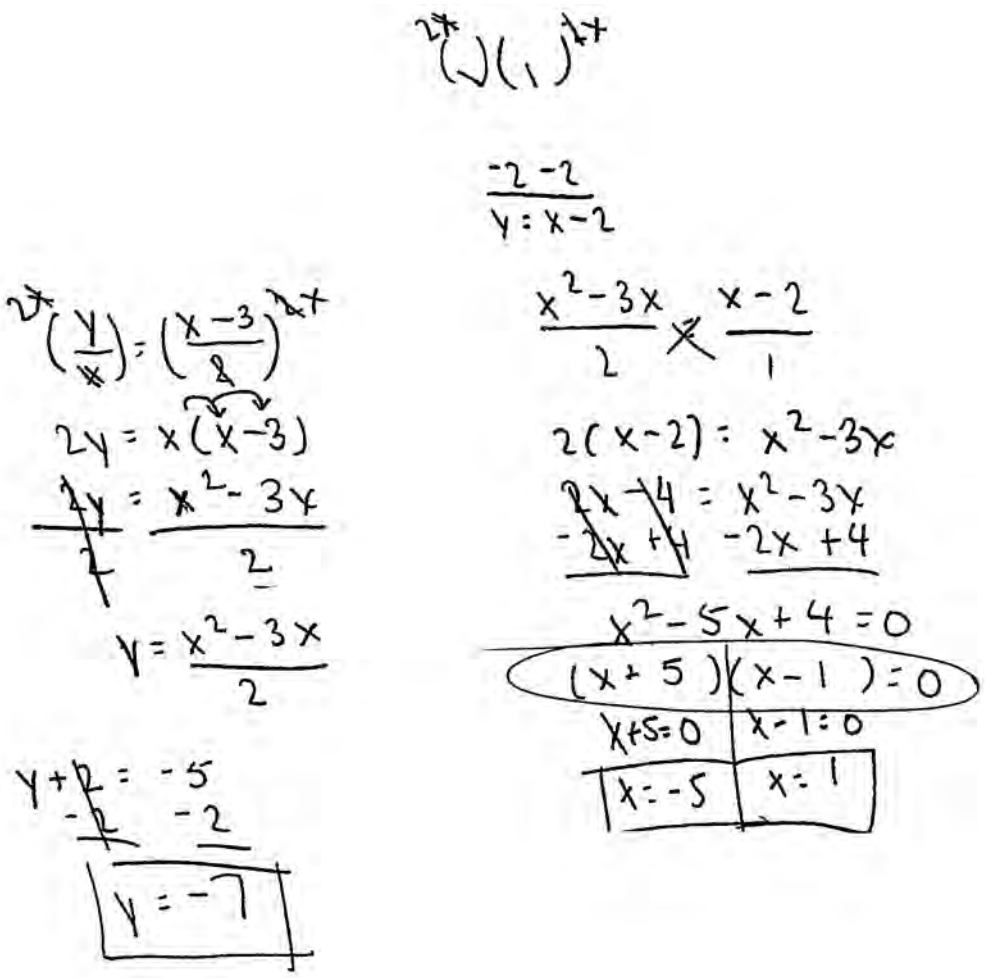
Score 2: The student made a conceptual error performing the cross product.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$



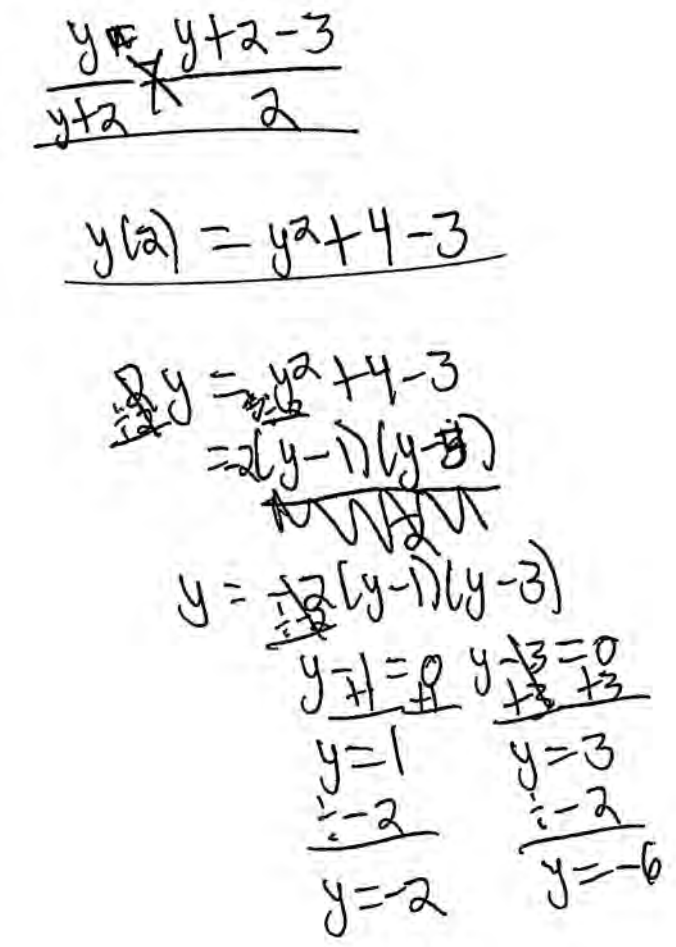
Score 2: The student did not factor correctly and only found one pair of solutions.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

$$y + 2 = x$$



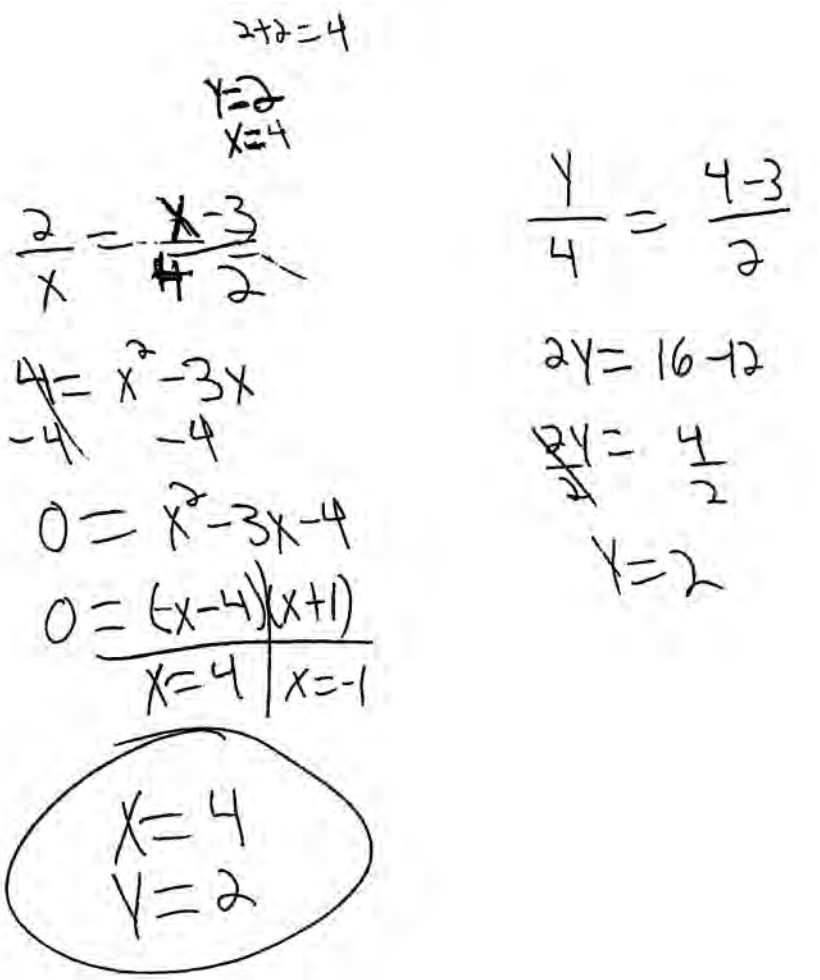
Score 1: The student wrote a correct equation in one variable, but then made numerous errors.

Question 37

37 Solve the system of equations algebraically for x and y:

$$\frac{y}{x} = \frac{x-3}{2}$$

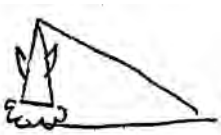
$$y + 2 = x$$



Score 0: The student obtained one correct solution by an obviously incorrect procedure.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.



$h = -16t^2 + 184t$

$529 = -16t^2 + 184t$ -529

-529

$-16t^2 + 184t - 529 = 0$

let $t = x$

$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$X = \frac{-184 \pm \sqrt{184^2 - 4(-16)(-529)}}{2(-16)}$

$X = \frac{-184 \pm \sqrt{33856 - 33856}}{-32}$

$X = \frac{-184}{-32}$

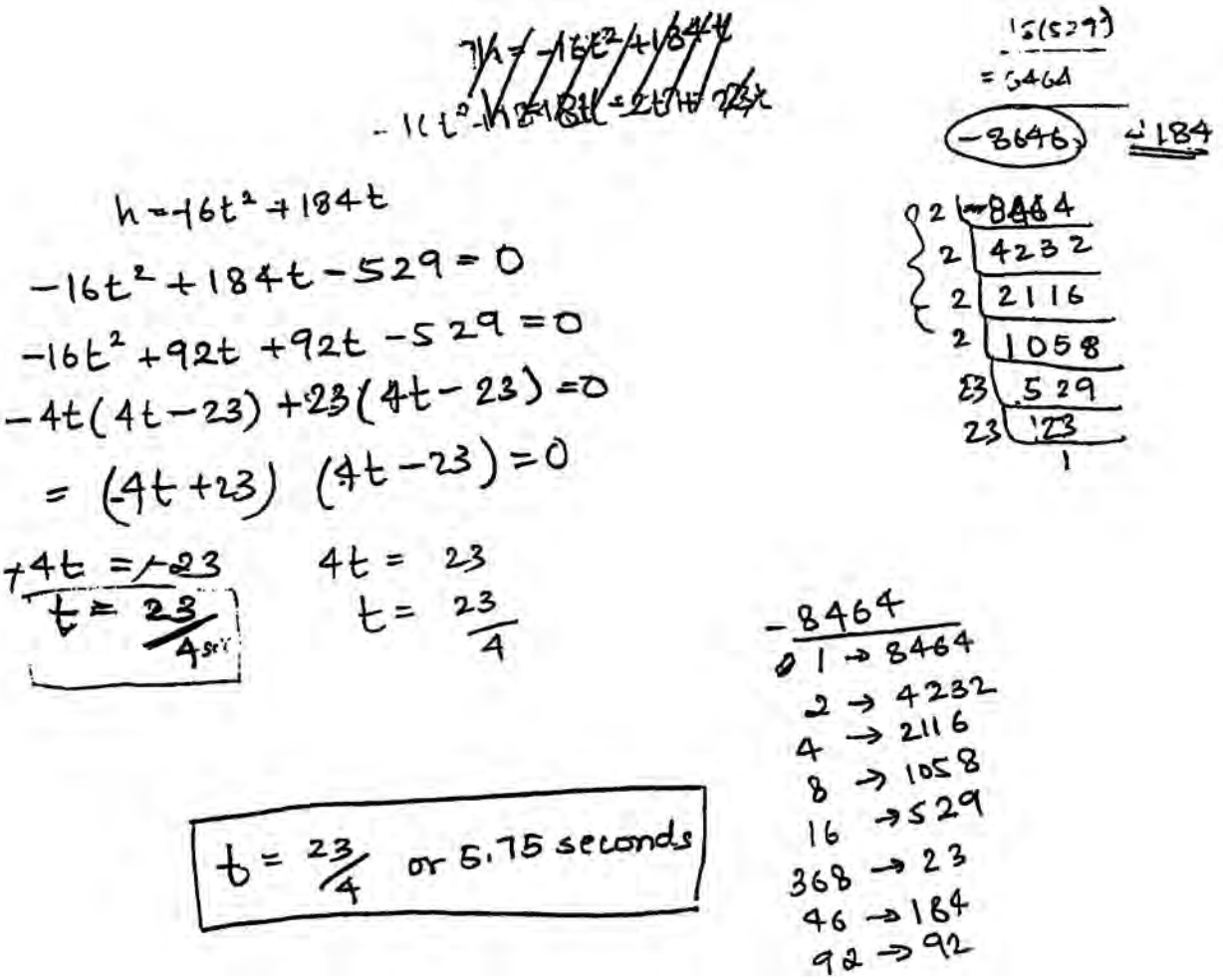
$X = \frac{23}{4}$

$t = \frac{23}{4}$

Score 4: The student gave a complete and correct response.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.



Score 4: The student gave a complete and correct response.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$529 = -16t^2 + 184t$

$-16t^2 + 184t - 529 = 0$

$x = \frac{-(184) \pm \sqrt{(184)^2 - 4(-16)(-529)}}{2(-16)}$

$\frac{-184 \pm \sqrt{33856 - 33856}}{-32}$

$\frac{-184}{-32} = 5.25$

Score 3: The student made one error when converting the fraction to a decimal.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$529 = -16t^2 + 184t$

$+16t^2$

$16t^2 - 184t + 529 = 0$

$\frac{+184 \pm \sqrt{184^2 - 4(16)(529)}}{2(16)}$

$\frac{184 \pm \sqrt{0}}{32}$

$= \frac{23 \pm 0}{2}$

$\frac{46 \pm \sqrt{0}}{4}$

Score 3: The student made an error when reducing the fraction $\frac{184 \pm \sqrt{0}}{32}$.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$529 = -16t^2 + 184t$

$16t^2 - 184t + 529 = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-(-184) \pm \sqrt{(-184)^2 - 4(16)(529)}}{2(16)}$

$x = \frac{+184 \pm \sqrt{33856 - 33856}}{32}$

$x = \frac{-184 \pm \sqrt{0}}{32}$

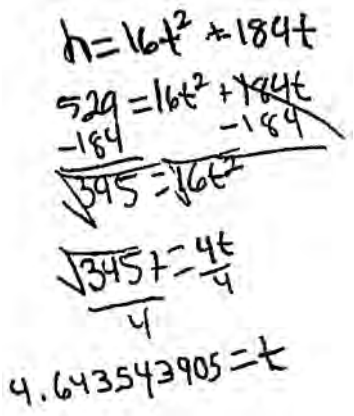
$x = \frac{-184}{32}$

$x = -\frac{23}{4}$

Score 2: The student wrote -184 instead of 184 in the quadratic formula. The final answer did not make sense in the context of the problem.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.



Score 1: The student made a transcription error when writing the equation and made a conceptual error by subtracting 184 instead of $184t$.

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.

$529 = -16t^2 + 184t$

$529 = -32t + 184t$

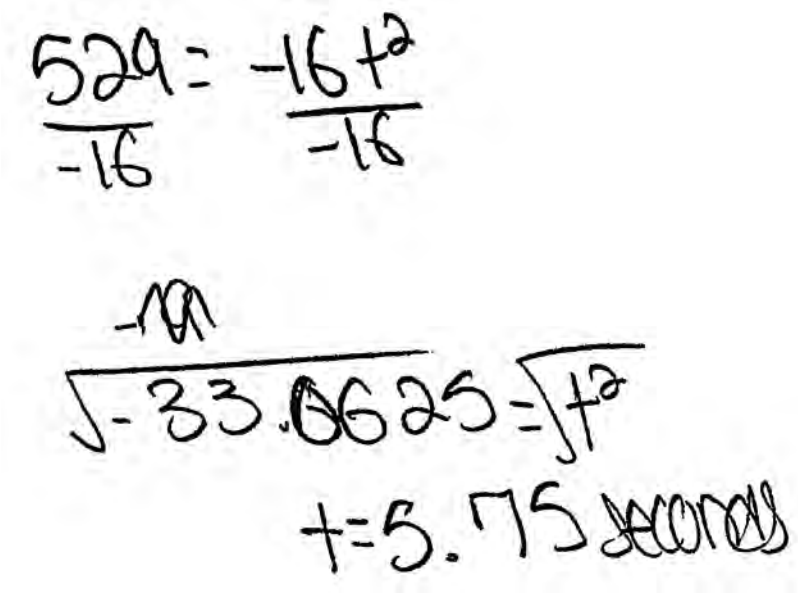
$\frac{529}{152} = \frac{152t}{152}$

3.4 seconds

Score 0: The student made a conceptual error when going from line 1 to line 2, creating a simpler linear equation for which no credit was earned, and made a rounding error.

Question 38

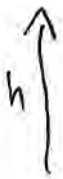
38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.



Score 0: The student obtained a correct answer by an obviously incorrect procedure

Question 38

38 A rocket is shot vertically into the air. Its height, h, at any time, t, in seconds, can be modeled by the equation $h = -16t^2 + 184t$. Determine algebraically, the number of seconds it will take the rocket to reach a height of 529 feet.



$529 = -16t^2 + 184t$

$-529 \qquad -529$

$0 = -16t^2 + 184t - 529$

$(-4t + \quad)(4t - \quad)$

$529 = -16t^2 + 184t$

$-184t \qquad -184t$

$529 - 184t = -16t^2$

16

64

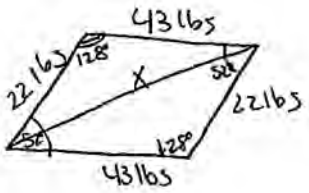
256

$t = 13 \qquad 2176$

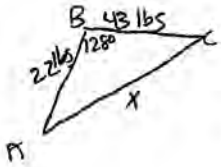
Score 0: The student did not show enough work to receive any credit.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



180°-52°=128°



$b^2 = a^2 + c^2 - 2ac\cos B$

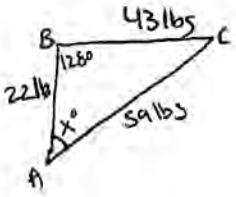
$b^2 = (43)^2 + (22)^2 - 2(43)(22)\cos 128°$

$b^2 = 1849 + 484 - 1892\cos 128°$

$\sqrt{b^2} = \sqrt{2333 - 1892\cos 128}$

$b \approx 59$ lbs. Resultant force ≈ 59 lbs.

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.



$\frac{\sin A}{a} = \frac{\sin B}{b}$

$\frac{\sin A}{43\text{lbs}} = \frac{\sin 128}{59\text{lbs}}$

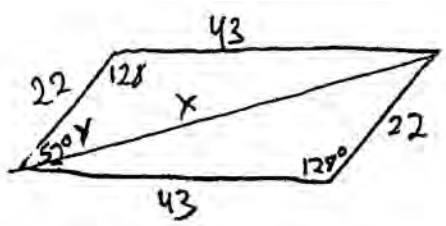
$\frac{59\sin A}{59} = \frac{43\sin 128}{59}$

$\sin^{-1}\left(\frac{43\sin 128}{59}\right) \approx 35°$

Score 6: The student gave a complete and correct response.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$x^2 = 22^2 + 43^2 - 2(22)(43)\cos 128$

$= 2333 + 1164.8$

$= 3497.8$

$x = 59$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$43^2 = 22^2 + 59^2 - 2(22)59\cos y$

$1849 = 3965 - 2596\cos y$

$-2116 = -2596\cos y$

$.8151 = \cos y$

$35 = y$

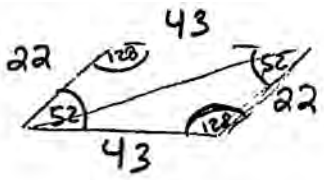
Score 6: The student gave a complete and correct response.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

59

$180 - 52 = 128$



$a^2 = b^2 + c^2 - 2bc(\cos A)$

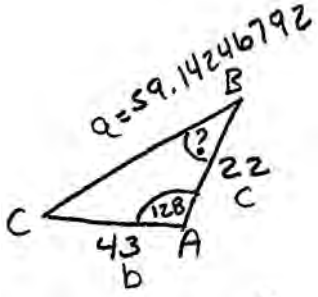
$a^2 = 43^2 + 22^2 - 2(43)(22)(\cos 128)$

$\sqrt{a^2} = \sqrt{3497.831511}$

$a = 59.14246792$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

35°



$\frac{a}{\sin A} = \frac{b}{\sin B}$

$\frac{59.14246}{\sin 128} = \frac{43}{\sin B}$

$\frac{33.88446241}{59.14246} = \frac{59.14246 \sin B}{59.14246}$

$\sin B = .57292954$

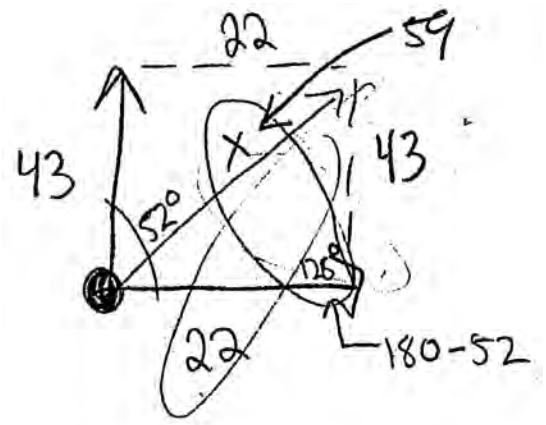
$\text{ref } \measuredangle = 34.9547$

$\approx 35°$

Score 6: The student gave a complete and correct response.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$a^2 = b^2 + c^2 - 2bc\cos A$

$a^2 = (22)^2 + (43)^2 - 2(22)(43)\cos 128°$

$\sqrt{a^2} = \sqrt{3497.83\ldots}$

$a = 59.14 \rightarrow \boxed{59}$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$\frac{\sin x}{x} = \frac{\sin y}{y}$

$\frac{\sin 128°}{59} = \frac{\sin x}{22}$

$x = 17.08$

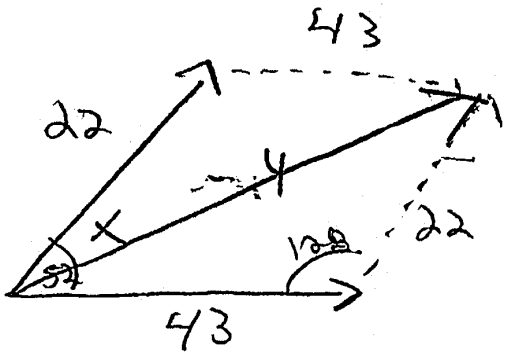
$\boxed{17°}$

Score 5: The student did not solve for the correct angle. Since the student only gave one legible response to find 59, it can be scored, even though it is crossed out.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$180 - 52 = 128$



$a^2 = b^2 + c^2 - 2(b)(c)\cos A$

$y^2 = 43^2 + 22^2 - 2(43)(22)\cos 128$

$y^2 = 2333 + 1164.831511$

$\sqrt{y^2} = \sqrt{3497.831511}$

$y = 59.14246792$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$\frac{59.1424...}{\sin 128} = \frac{22}{\sin x}$

$19.33623658 = \frac{59.1421}{\sin x}$

$\sin x = .2931267022$

$x = 17°21'$

$x = 17°$

Score 4: The student did not round the magnitude to 59 and solved for the wrong angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

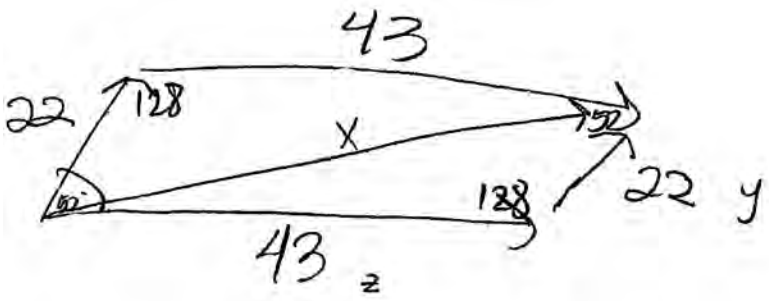
$X^2 = y^2 + z^2 - 2yz\cos X$

$X^2 = 22^2 + 43^2 - 2(22)(43)\cos 128°$

$X^2 = 2333 - 1892\cos 128°$

$\sqrt{X^2} = \sqrt{3497.831511}$

$X = 59$

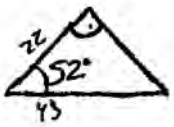


Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 4: The student only determined the magnitude.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$c^2 = 1168.168489$

$c = \sqrt{1168.168489}$

$c = 34.178447991$

$c^2 = a^2 + b^2 - 2ab\cos C$

$c^2 = 22^2 + 43^2 - 2(22)(43)\cos 52$

$c^2 = 484 + 1849 - 1892\cos 52$

$c^2 = 2333 - 1164.831511$

resultant force = 34 pounds

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$\frac{\sin a}{43} = \frac{\sin 52}{34}$

$43\sin 52 = 34\sin a$

$\sin a = .9966018354$

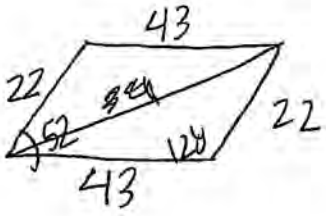
$a = 85.27520583$

$m\angle = 85°$

Score 4: The student made a conceptual error by using 52° instead of 128° when solving for both the magnitude and the angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



a^2

$180 - 52 = 128$

$a^2 = b^2 + c^2 - 2bc\cos A$

$a^2 = (43)^2 + (22)^2 - 2 \cdot 43 \cdot 22 \cdot \cos 128°$

$a^2 = 1{,}849 + 484 - 1{,}164.831511$

$\sqrt{a^2} = \sqrt{1{,}168.168489}$

$a = 34.17847991$

$a = 34$ magnitude = 34 lbs

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$22^2 = 43^2 + 34^2 - 2(43)(34)(\cos A)$

$184 = 3{,}005 - 2924\cos A$

$-3{,}005 \quad -3{,}005$

$\frac{-2821}{-2924} = \frac{-2924\cos A}{-2924}$

$\cos A = .8621751026$

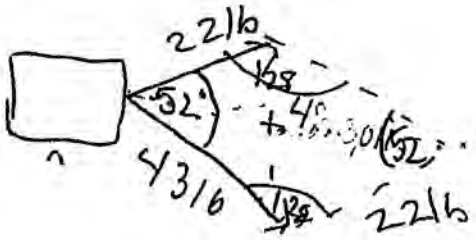
$A = 30.43831245$

$A = 30°$

Score 4: The student made an error in sign when computing the magnitude and found the wrong angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$a^2 = b^2 + c^2 - 2bc\cos A$

$a^2 = 22^2 + 43^2 - 2(22)(43)\cos 128$

$a^2 = 3497.83$

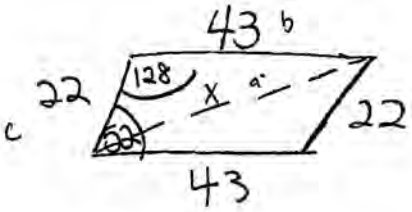
$a = 59.14$ lb

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 3: The student did not round the magnitude correctly and did not find the correct angle.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$a^2 = b^2 + c^2 - 2bc \cos A$

$a^2 = 43^2 + 22^2 - 2(43)(22)\cos 128$

$a^2 = 1849 + 484 - 1892 \cos 128$

$a^2 = 2333 - 1892 \cos 128$

$a^2 = 2333 + 1310.958895$

$\sqrt{a^2} = \sqrt{1022.041105}$

$a = 31.96937761$

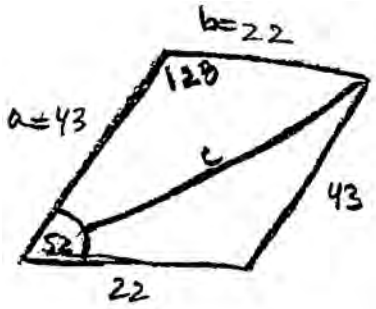
32°

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

Score 2: The student only made a correct substitution into the Law of Cosines.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



$\frac{c}{\sin 128} = \frac{22}{\sin 52}$

$c \sin 52 = 22 \sin 128$

$\frac{c \sin 52}{\sin 52} = \frac{22 \sin 128}{\sin 52}$

$c = 22$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

$\frac{43}{\sin A} = \frac{22}{\sin 128}$

$43 \sin 128 = 22 \sin A$

$\frac{43 \sin 128}{22} = \frac{22 \sin A}{22}$

$\sin A = .154020\ldots$

$m\angle A = 32.697\ldots$

$33°$

Score 1: The student only drew a correct diagram.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.

$c^2 = (22)^2 + (43)^2 - 2(22)(43)\cos 52$

$\sqrt{c^2} = \sqrt{2641}$

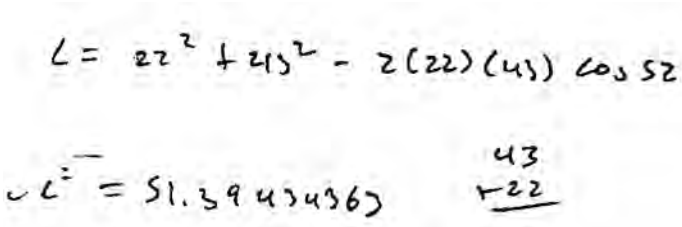
$c = 51.39$

Find, to the *nearest degree,* the angle between the smaller force and the resultant force.

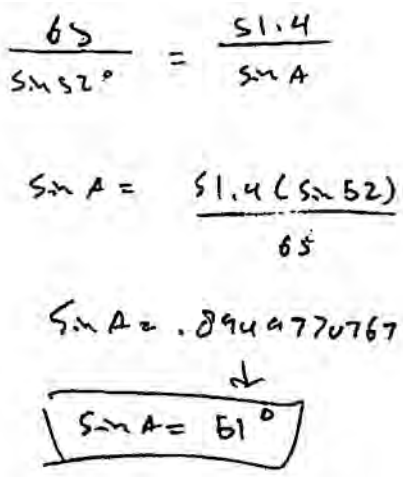
Score 0: The student used 52° instead of 128° and made both a computational and a rounding error.

Question 39

39 Forces of 22 pounds and 43 pounds act on an object at an angle of 52°. Determine, to the *nearest pound,* the magnitude of the resultant force.



Find, to the *nearest degree,* the angle between the smaller force and the resultant force.



Score 0: The student used 52° instead of 128°, calculated in radians and did not round correctly. The student also added the forces and made a computational error.