

NAME:

Solution Key

Secondary 4 Math CST

Midterm Exam Outline

Topics: Sept - Dec

Mrs. Nassif

The midterm exam is worth 40% of Competency 2.

Exam Date: Wednesday December 22nd in the morning

Memory aid:

- ❖ Size 8.5 inches by 11 inches
- ❖ Both sides
- ❖ hand-written

Anything typed or photocopied will result in a grade of 0%.

Bring your ID to the exam. Any student who has an electronic device on them will be given a zero on the exam.

Exam Breakdown

4 Multiple Choice Questions (4 points each)	16 Marks
3 Short Answer Questions (4 points each)	12 Marks
4 Extended Answer Questions (10 points each)	<u>40 Marks</u>
Total	68 Marks



Midterm Exam Outline

Linear Equations

- ❖ Graph an equation
- ❖ Find the slope, y-intercept, x intercept
- ❖ General and functional form

System of Equations

- ❖ Algebraically (Comparison, Substitution, Elimination)
- ❖ Graphically
- ❖ Types of Lines (Secant, Coincident, Perpendicular, Parallel)
- ❖ Word Problems (4 types)

Analytic Geometry

- ❖ Distance
- ❖ Midpoint
- ❖ Division Point
- ❖ Parallel & Perpendicular lines
- ❖ Equation of horizontal & vertical lines

Functions

- ❖ Exponential



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Midterm Review

Line \overline{AB} passes through the points $A(4, -3)$ and $B(6, 5)$.

- a) What is the rate of change of line \overline{AB} ?
- b) What is the y-intercept of line \overline{AB} ?
- c) What is the equation of line \overline{AB} ?
- d) What is the equation of line L, parallel to line \overline{AB} , and passing through (2, 3)?
- e) What is the equation of line L, perpendicular to line \overline{AB} , and passing through (0, 5)?

a) (ROC) Slope: $\frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - (-3)}{6 - 4} = \frac{8}{2} = \boxed{4}$

c) $y = 4x - 19$

b) $y = 4x + b$
 $(5) = 4(6) + b$
 $5 = 24 + b$
 $-24 \quad -24$
 $\boxed{b = -19}$

$y = 4(6) - 19$
 $\boxed{y = -19}$

d) $y = 4x + b$
 $(3) = 4(2) + b$
 $3 = 8 + b$
 $-8 \quad -8$
 $\boxed{b = -5}$

Rule: $y = 4x - 5$

e) perp of 4 $\rightarrow -\frac{1}{4}$

$y = -\frac{1}{4}x + b$
 $(5) = -\frac{1}{4}(0) + b$
 $5 = b$

a)	Rate of change = 4
b)	$(0, -19)$
c)	$y = 4x - 19$
d)	$y = 4x - 5$
e)	$y = -\frac{1}{4}x + 5$



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Midterm Review

Determine the y-intercept in the equation: $5x - 3y + 15 = 0$.

$$\begin{array}{r} -5x \\ 5x - 3y + 15 = 0 \end{array} \quad \begin{array}{r} -15 \\ -15 \end{array}$$

$$\frac{-3y}{-3} = \frac{-5x - 15}{-3}$$

$$y = -\frac{5}{3}x + 5$$

$$y = -\frac{5}{3}x + 5$$

$$y = -\frac{5}{3}(0) + 5$$

$$\boxed{y = 5}$$

y-intercept $\rightarrow (0, 5)$ Determine the x-intercept in the equation: $5x - 3y + 15 = 0$.

$$\begin{array}{r} 5x - 3y + 15 = 0 \\ -5x \quad \quad 15 \end{array}$$

$$\frac{-3y}{-3} = \frac{-5x - 15}{-3}$$

$$y = -\frac{5}{3}x + 5$$

 $(-3, 0)$

$$(0) = 1.66x + 5$$

$$\begin{array}{r} -5 \\ 1.66x = -5 \\ 1.67 \quad 1.67 \end{array}$$

$$x = -2.99$$

 $\rightarrow \boxed{-3}$



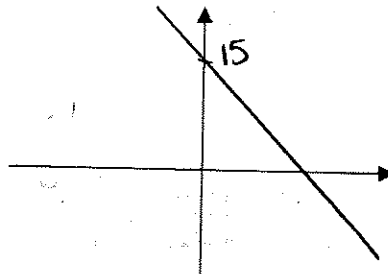
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Midterm Review

- 1.) Point $P(-5, 15)$ is on line L and the slope is negative.
(hint: make a sketch)



a) Will the x-intercept be positive or negative? Positive

b) Will the y-intercept be positive or negative? Positive

- 2.) A line has a slope of 4 and passes through the point $(3, -5)$.
Calculate the x-intercept.

$$y = 4x + b$$

$$(-5) = 4(3) + b$$

$$-5 = 12 + b$$

$$-17 = b$$

b = -17

$$\text{Rule: } y = 4x - 17$$

$$\text{x-intercept: } y = 4x - 17$$

$$0 = 4x - 17$$

$$+17 \quad +17$$

$$\frac{17}{4} = \frac{4x}{4}$$

x = 4.25

$$\text{x-int: } (4.25, 0)$$

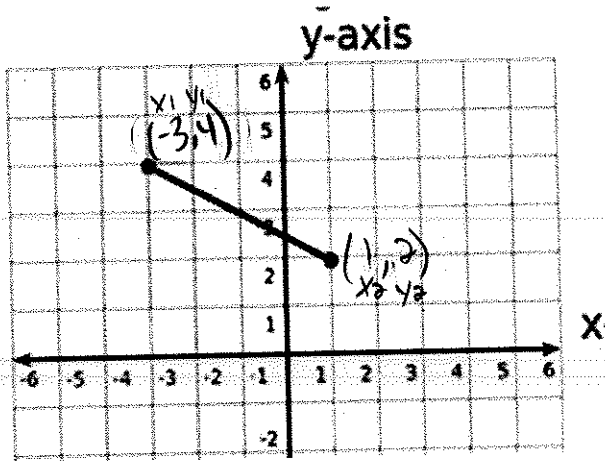


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Midterm Review

Line segment \overline{PQ} is represented in the Cartesian plane below.a) Determine the slope \overline{PQ} .Answer: $-\frac{1}{2}$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 4}{1 + 3} = \frac{-2}{4} = -\frac{1}{2} = -0.5$$

b) Determine the distance of \overline{PQ} .Answer: 4.47

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(1 + 3)^2 + (2 - 4)^2}$$

$$d = \sqrt{(4)^2 + (-2)^2}$$

$$d = \sqrt{16 + 4}$$

$$d = \sqrt{20}$$

$$d = 4.47$$

c) Determine the midpoint of \overline{PQ} .Answer: $(-1, 3)$

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$M = \left(\frac{-3 + 1}{2}, \frac{4 + 2}{2} \right)$$

$$M = \left(\frac{-2}{2}, \frac{6}{2} \right)$$

$$M = (-1, 3)$$



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Midterm Review

Convert the following equations into functional form and state the slope.

a) $-5x + 8y - 40 = 0$

$$\begin{array}{r} -5x \quad 8y - 40 = 0 + 5x + 40 \\ +5x \quad \quad +40 \end{array}$$

$$\frac{8y}{8} = \frac{5x + 40}{8}$$

$$y = 0.625x + 5$$

Functional form: $y = 0.625x + 5$

Slope: 0.625 or $\frac{5}{8}$

b) $\frac{12x}{4} - \frac{120}{4} = \frac{4y}{4}$

$$y = 3x - 30$$

Functional form: $y = 3x - 30$

Slope: 3



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Midterm Review

Find the missing x -coordinate.

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 6}{5 - 10} = \frac{-3}{-5} = \boxed{0.6}$$

Rule: $y = 0.6x$

$$y = 0.6x + b$$

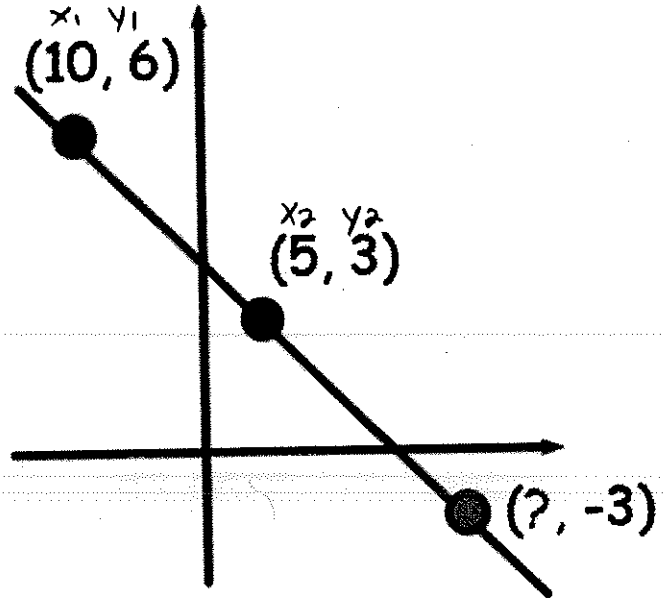
$$(3) = 0.6(5) + b$$

$$3 = 3 + b$$
$$-3 \quad -3$$

$$b = 0$$

x -coordinate
↓

$$y = 0.6x$$
$$\frac{(-3)}{0.6} = \frac{0.6x}{0.6}$$
$$\boxed{x = -5}$$



$(-5, -3)$



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Midterm Review

Find the missing y-coordinate.

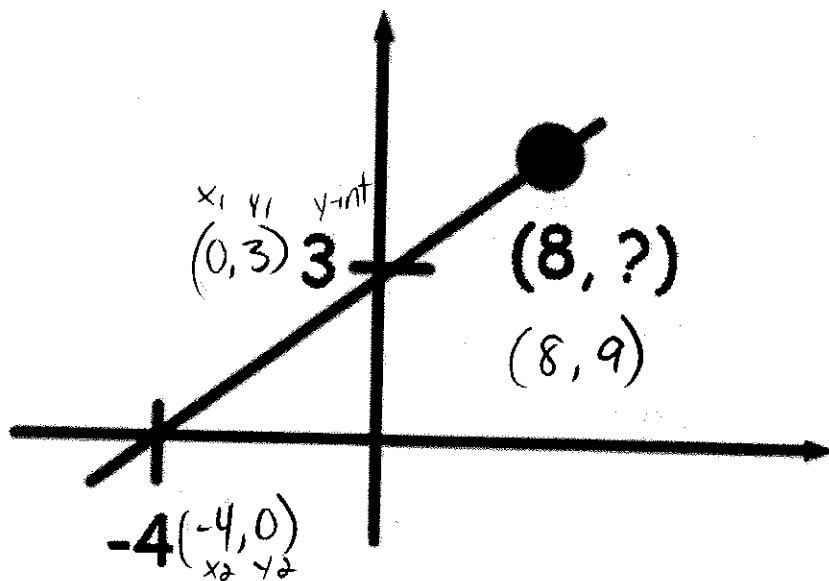
$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 3}{-4 - 0} = \frac{-3}{-4} = 0.75$$

$$\text{Rule: } y = 0.75x + 3$$

$$y = 0.75x + b$$

$$(3) = 0.75(0) + b$$

$$\boxed{b = 3}$$



"2"

$$y = 0.75x + 3$$

$$y = 0.75(8) + 3$$

$$y = 6 + 3$$

$$\boxed{y = 9}$$



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Midterm Review

Given the following lines:

Line 1: $2x - y - 1 = 0$

Line 3: $x - 2y + 12 = 0$

Line 2: $2x - y - 5 = 0$

Line 4: $-x - 2y - 6 = 0$

a)

Write each line in functional form.

$$l_1: \overset{-2x}{2x} - \overset{+1}{y} - 1 = 0 - 2x + 1$$

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

$$y = 2x - 1$$

$$l_3: \overset{-x}{x} - 2\overset{+12}{y} + 12 = 0 - x - 12$$

$$\frac{-2y}{-2} = \frac{-x-12}{-2}$$

$$y = \frac{1}{2}x + 6$$

$$l_2: \overset{-2x}{2x} - \overset{+5}{y} - 5 = 0 - 2x + 5$$

$$\frac{y}{-1} = \frac{-2x+5}{-1}$$

$$y = 2x - 5$$

$$l_4: \overset{+x}{-x} - 2\overset{+6}{y} - 6 = 0 + x + 6$$

$$\frac{-2y}{-2} = \frac{x+6}{-2}$$

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

Answers:	
Line 1	$y = 2x - 1$
Line 2	$y = 2x - 5$
Line 3	$y = \frac{1}{2}x + 6$
Line 4	$y = -\frac{1}{2}x - 3$

b) Line 1 is perpendicular to which other line? Answer: l_4 c) Which 2 lines are parallel? Answer: $l_1 + l_2$



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Midterm Review

Write the equation of a line that is perpendicular to $2x = y - 5$, and passes through the point $(-4, 4)$.

$$y = 2x + 5 \rightarrow \text{perp } y = -\frac{1}{2}x + b$$

$$\text{Rule: } y = -\frac{1}{2}x + b$$

$$(4) = -\frac{1}{2}(-4) + b$$

$$4 = 2 + b$$

$$b = 2$$

$$\text{Rule: } y = -\frac{1}{2}x + 2$$



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Midterm Review

Determine the point of intersection for the system of equations:

$$y = 4x - 8$$

$$2x + 3y = 4$$

$$\left. \begin{array}{l} 2x + 3y = 4 \\ y = 4x - 8 \end{array} \right\} \text{Substitution}$$



$$\begin{array}{l} 2x + 3y = 4 \\ 2x + 3(4x - 8) = 4 \end{array}$$

$$\begin{array}{r} 2x + 12x - 24 = 4 \\ \quad \quad \quad +24 \quad +24 \end{array}$$

$$\frac{14x}{14} = \frac{28}{14}$$

$$\boxed{x = 2}$$

$$y = 4x - 8$$

$$y = 4(2) - 8$$

$$y = 8 - 8$$

$$\boxed{y = 0}$$

$$\text{POI: } (2, 0)$$



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Midterm Review

FIND COORDINATE A.

$$\textcircled{1} a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 40}{20 - 60} = \frac{-40}{-40} = 1$$

$$\textcircled{2} y = -1x + b$$

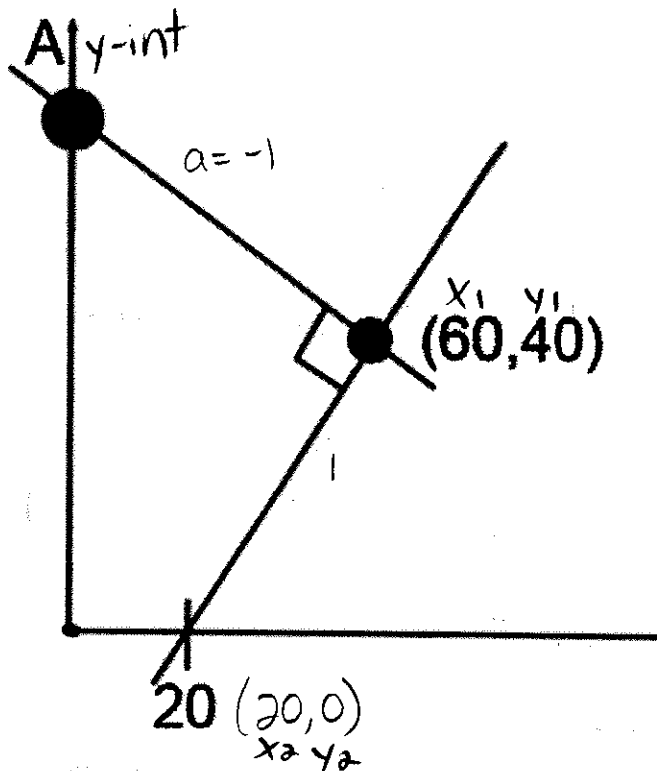
$$(40) = -1(60) + b$$

$$\text{Rule: } y = -1x + 100$$

$$40 = -60 + b$$

$$+60 \quad +60$$

$$b = 100$$



$\textcircled{3}$ y-int (plug x as 0)

$$y = -1x + 100$$

$$y = -1(0) + 100$$

$$y = 100$$

coordinate A = $(0, 100)$



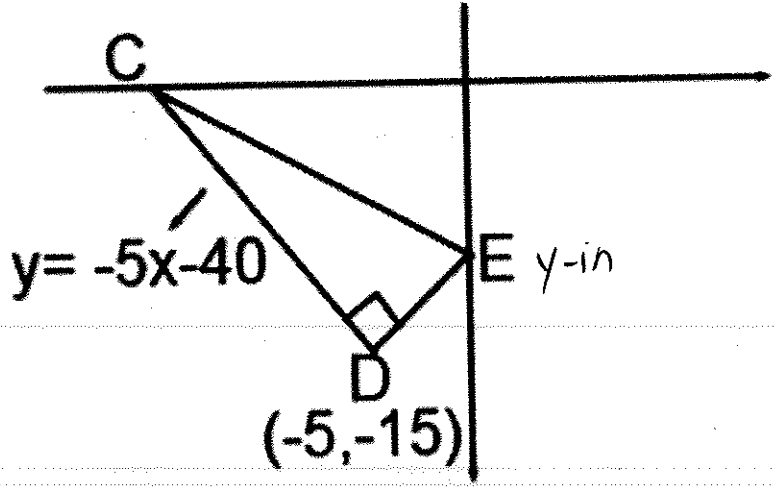
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Midterm Review

DETERMINE COORDINATE E.



Slope of \overline{DE} \rightarrow perp to \overline{CD}

$-5 \rightarrow \frac{1}{5}$

$y = \frac{1}{5}x + b$

Rule: $y = \frac{1}{5}x - 14$

$(-5) = \frac{1}{5}(-5) + b$

$(-5) = -1 + b$

$b = -14$

Coordinate E (y-int)

$y = \frac{1}{5}x - 14$

$y = \frac{1}{5}(0) - 14$

$y = -14$

$(0, -14)$



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Midterm Review

Two friends are saving to travel to Australia for the summer. Jeff deposits \$1050 in a savings account that accumulates an interest of 0.03% per month. Suzie deposits \$1200 in a saving account that accumulates an interest rate of 0.02% per month. Which friend will have more money to travel to Australia in 2 years?

$$\text{Jeff: } \uparrow 0.03\% \\ 1 + \frac{0.03}{100} = 1.0003$$

$$\text{Suzie: } \uparrow 0.02\% \\ 1 + \frac{0.02}{100} = 1.0002$$

12 months \times 2 year
total of 24 month
 \downarrow (x)

$$\text{Jeff: } y = 1050(1.0003)^{24} \\ y = \$1057.59$$

$$\text{Suzie: } y = 1200(1.0002)^{24} \\ y = \$1205.77$$

Suzie will have more money for Australia



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Midterm Review

On the same day in January 2010, Daniel bought a truck and Jack bought a car. Since then the value of each vehicle has decreased annually with respect to its previous year's value. The following function describes how the value of Daniel's truck has decreased

$$f(x) = 31000 (0.89)^x$$

where x = years since purchase

$$f(x) = \text{value of truck}$$

Jack paid \$25000 for his car in January 2010 and his car has been depreciating at a rate of 12% annually.

When Daniel's truck is worth \$15406.42, how much will Jack's car be worth?

Daniel: $y = 31000 (0.89)^x$

$$\frac{15406.42}{31000} = \frac{31000 (0.89)^x}{31000}$$

$$0.49 = (0.89)^x$$

$$\boxed{x=6} \leftarrow \text{years}$$

Jack: $y = 25000 (0.88)^6$

$$\boxed{y = \$11610.10}$$

Jack: $\downarrow 12\%$

$$1 - \frac{12}{100} = \boxed{0.88}$$



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Midterm Review

Norman was driving to his chalet for the weekend. However, when he was located at coordinates $(26, -10)$, his gas light turned on indicating that he could only travel another 50 km before his car would run out of gas. His Global Positioning System (GPS) gave the coordinates of the closest gas station at $(-9, 2)$. Will he be able to make it to the gas station? All distances are in kilometres.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(-9 - 26)^2 + (2 + 10)^2}$$

$$d = \sqrt{(-35)^2 + (12)^2}$$

$$d = \sqrt{1225 + 144}$$

$$d = \sqrt{1369}$$

$$d = 37 \text{ km}$$

He will make it to the gas station with 13 km left of gas.



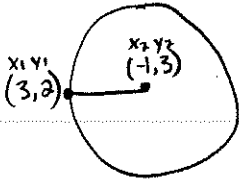
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Midterm Review

A circle has its centre at point O (-1, 3). The point A (3, 2) is on its circumference. Calculate the diameter of the circle.



$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(-1 - 3)^2 + (3 - 2)^2}$$

$$d = \sqrt{(-4)^2 + (1)^2}$$

$$d = \sqrt{16 + 1}$$

$$d = \sqrt{17}$$

$$d = 4.12$$

$$\text{diameter} = 4.12 \times 2$$

$$8.24$$

Determine the coordinates of the mid-point of the line segment AB where A = (4, -1) and B = (0, -5).

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_2 + y_1}{2} \right)$$

$$M = \left(\frac{4 + 0}{2}, \frac{-5 - 1}{2} \right)$$

$$M = \left(\frac{4}{2}, \frac{-6}{2} \right)$$

$$M = (2, -3)$$



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Midterm Review

Given the end-points $A = (-3, 1)$ and $B = (6, 4)$ of line segment AB, what are the coordinates of the point P that divides segment AB in the ratio 1 : 2 from point A?

$$P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$P = \left(\frac{1(6) + 2(-3)}{1+2}, \frac{1(4) + 2(1)}{1+2} \right)$$

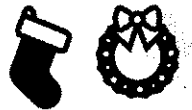
$$P = \left(\frac{6-6}{3}, \frac{4+2}{3} \right)$$

$$P = \left(\frac{0}{3}, \frac{6}{3} \right)$$

$$P = (0, 2)$$



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Midterm Review

$\frac{a}{b}$
2:3

If the point P is located $\frac{2}{5}$ of the way along segment

AB from point B, what are the coordinates of point P if
A = (-1, 7) and B = (-6, 2) are the end-points of segment
AB? x_2, y_2 x_1, y_1

$$P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$P = \left(\frac{2(-1) + 3(-6)}{2+3}, \frac{2(7) + 3(2)}{2+3} \right)$$

$$P = \left(\frac{-2 - 18}{5}, \frac{14 + 6}{5} \right)$$

$$P = \left(\frac{-20}{5}, \frac{20}{5} \right)$$

$$P = (-4, 4)$$



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Midterm Review

Find the equation of the line that is perpendicular to the line $y = \frac{2}{7}x - 5$ and passing through the point $A(3, 2)$.

$$\frac{2}{7} \rightarrow -\frac{7}{2} \rightarrow -3.5$$

$$\begin{aligned} y &= -3.5x + b \\ (2) &= -3.5(3) + b \\ 2 &= -10.5 + b \\ +10.5 &+10.5 \\ \boxed{b} &= \boxed{12.5} \end{aligned}$$

$$\boxed{\text{Rule: } y = -3.5x + 12.5}$$



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Midterm Review

Consider two lines on the Cartesian Plane.

$$l_1: 8y - 4x = 32$$

$$l_2: 2y - 14 = x$$

What is the relationship between l_1 and l_2 ?

- a. l_1 and l_2 are intersecting lines
- b. l_1 and l_2 are parallel and distinct lines
- c. l_1 and l_2 are parallel and coincident lines
- d. l_1 and l_2 are perpendicular lines

Show work here.

$$l_1: 8y - 4x = 32 + 4x$$

$$\frac{8y}{8} = \frac{4x + 32}{8}$$

$$y = \frac{1}{2}x + 4$$

$$l_2: 2y + 14 = x + 14$$

$$\frac{2y}{2} = \frac{x + 14}{2}$$

$$y = \frac{1}{2}x + 7$$

B



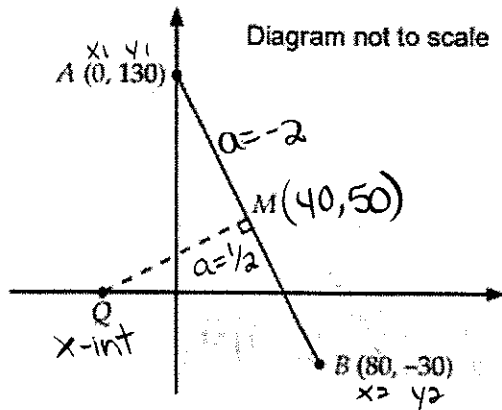
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Midterm Review

Mary has moved into a new development underway in her neighborhood. A new section of road \overline{MQ} is to be built as shown below. If point M is the midpoint of segment \overline{AB} and segment \overline{MQ} is perpendicular to segment \overline{AB} , find the length of the new road \overline{MQ} .



$$M(A, B) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$M = \left(\frac{0 + 80}{2}, \frac{130 + (-30)}{2} \right)$$

$$M = \left(\frac{80}{2}, \frac{100}{2} \right)$$

$$M = (40, 50)$$

$$\text{Slope of } \overline{AB}: \frac{y_2 - y_1}{x_2 - x_1} = \frac{-30 - 130}{80 - 0} = \frac{-160}{80}$$

$$a = -2$$

$$\text{Rule of } \overline{MQ}: y = \frac{1}{2}x + b$$

$$(50) = \frac{1}{2}(40) + b$$

$$50 = \cancel{20} + b$$

$$b = 30$$

coordinate Q

$$\downarrow$$

$$(-60, 0)$$

$$\text{Rule: } y = \frac{1}{2}x + 30$$

x-int ercept (Q)

$$y = \frac{1}{2}x + 30$$

$$(0) = 0.5x + 30$$

$$\frac{-30}{0.5} = \frac{0.5x}{0.5} - 30$$

$$x = -60$$



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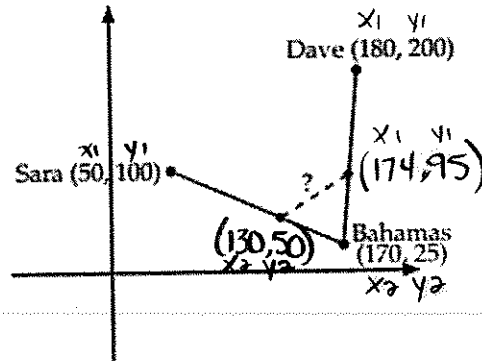
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Sara and Dave are planning to meet in the Bahamas for spring break. Sara will take a direct flight from Toronto and Dave will fly from Montreal. The layout is graphed on the Cartesian Plane scaled in kilometres.

When Sara has traveled $\frac{2}{3}$ of the distance to the Bahamas, she decides to send Dave a message. At this point in time, Dave's position divides the path between Montreal and the Bahamas in a ratio of $\frac{3}{2}$. How far apart are Dave and Sara when the message is sent?



$$① P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$P = \left(\frac{2(170) + 1(50)}{2+1}, \frac{2(25) + 1(100)}{2+1} \right)$$

$$P = \left(\frac{340 + 50}{3}, \frac{50 + 100}{3} \right)$$

$$P = \left(\frac{390}{3}, \frac{150}{3} \right) \rightarrow P = (130, 50)$$

$$② P(x_p, y_p) = \left(\frac{3(170) + 2(180)}{3+2}, \frac{3(25) + 2(200)}{3+2} \right)$$

$$P = \left(\frac{510 + 360}{5}, \frac{75 + 400}{5} \right)$$

$$P = \left(\frac{870}{5}, \frac{475}{5} \right)$$

$$P = (174, 95)$$

$$③ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(130 - 174)^2 + (50 - 95)^2}$$

$$d = \sqrt{(-44)^2 + (-45)^2}$$

$$d = \sqrt{1936 + 2025}$$

$$d = \sqrt{3961}$$

$$d = 62.94$$

Dave and Sara are 62.94 units apart.



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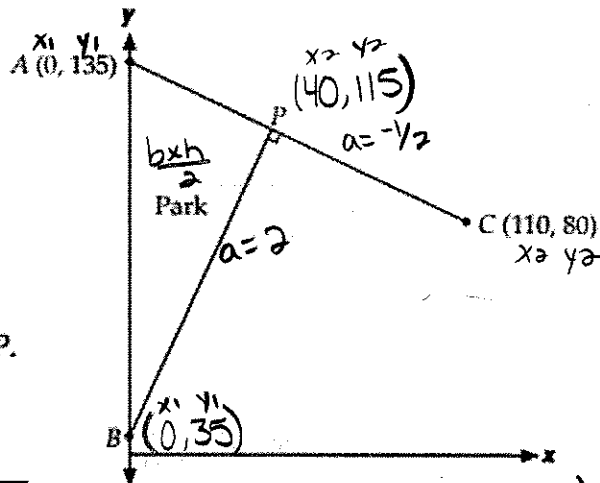
Midterm Review

A local municipality would like to designate an area for a park. The situation has been scaled in metres on the following Cartesian Plane.

- Point P is located along segment \overline{AC} in a ratio of 4:7.
- \overline{AC} is perpendicular to \overline{PB} .
- The area designated for the park is $\triangle ABP$.

What is the area of the park?

1999.88



$$\text{* Area of Park} = \frac{d(A,P) \times d(B,P)}{2}$$

$$\textcircled{4} \quad d(A,P) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(40 - 0)^2 + (115 - 135)^2}$$

$$d = \sqrt{(40)^2 + (-20)^2}$$

$$d = \sqrt{1600 + 400}$$

$$d = \sqrt{2000}$$

$$d(A,P) = 44.72$$

$$\textcircled{5} \quad d(B,P) = \sqrt{(40 - 0)^2 + (115 - 35)^2}$$

$$d = \sqrt{(40)^2 + (80)^2}$$

$$d = \sqrt{1600 + 6400}$$

$$d = \sqrt{8000}$$

$$d(B,P) = 89.44$$

$$\text{Area of park} = \frac{b \times h}{2}$$

$$= \frac{44.72 \times 89.44}{2}$$

$$= \frac{3999.76}{2}$$

$$\boxed{\text{Area} = 1999.88}$$

$$\textcircled{1} \quad P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$P = \left(\frac{4(110) + 7(0)}{4+7}, \frac{4(80) + 7(135)}{4+7} \right)$$

$$P = \left(\frac{440 + 0}{11}, \frac{320 + 945}{11} \right)$$

$$P = \left(\frac{440}{11}, \frac{1265}{11} \right) \rightarrow P = (40, 115)$$

$$\textcircled{2} \quad \text{slope of } \overline{AC} : \frac{y_2 - y_1}{x_2 - x_1} = \frac{80 - 135}{110 - 0} = \frac{-55}{110} = -\frac{1}{2} \text{ perp}$$

$$\textcircled{3} \quad \text{coordinate B: } y = 2x + b$$

$$(115) = 2(40) + b$$

$$115 = 80 + b$$

$$-80 \quad -80$$

$$b = 35$$

$$\text{Rule: } y = 2x + 35$$

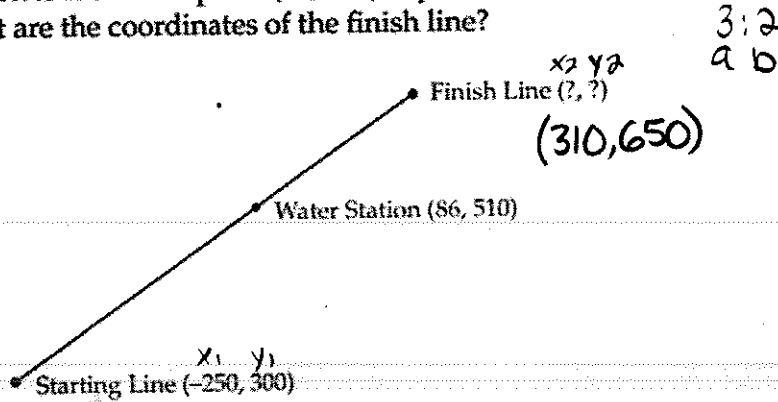


Name: _____



Midterm Review

On the night before an extreme cycling race, Sylvie receives a detailed map of the course scaled in km. She sees that the course is a straight line and it starts at the point $(-250, 300)$. The main water station is located at point $(86, 510)$. Sylvie knows it is located $\frac{3}{5}$ of the way into the course. What are the coordinates of the finish line?



$$P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$(86, 510) = \left(\frac{3(x) + 2(-250)}{3+2}, \frac{3(x) + 2(300)}{3+2} \right)$$

$$\left(\frac{430}{5}, \frac{2550}{5} \right) = \left(\frac{3x - 500}{5}, \frac{3x + 600}{5} \right)$$

$$\left(\begin{array}{l} 3x - 500 = 430 \\ +500 \quad +500 \\ \hline 3x = 930 \\ \frac{3x}{3} = \frac{930}{3} \\ \boxed{x = 310} \end{array} \right) \quad \left(\begin{array}{l} 3x + 600 = 2550 \\ -600 \quad -600 \\ \hline 3x = 1950 \\ \frac{3x}{3} = \frac{1950}{3} \\ x = 650 \\ (y_2) \end{array} \right)$$

$$x_2 = 310 \quad y_2 = 650 \quad \rightarrow (310, 650)$$

CANCELLED



Name: _____

Math 4 CST



Midterm Review

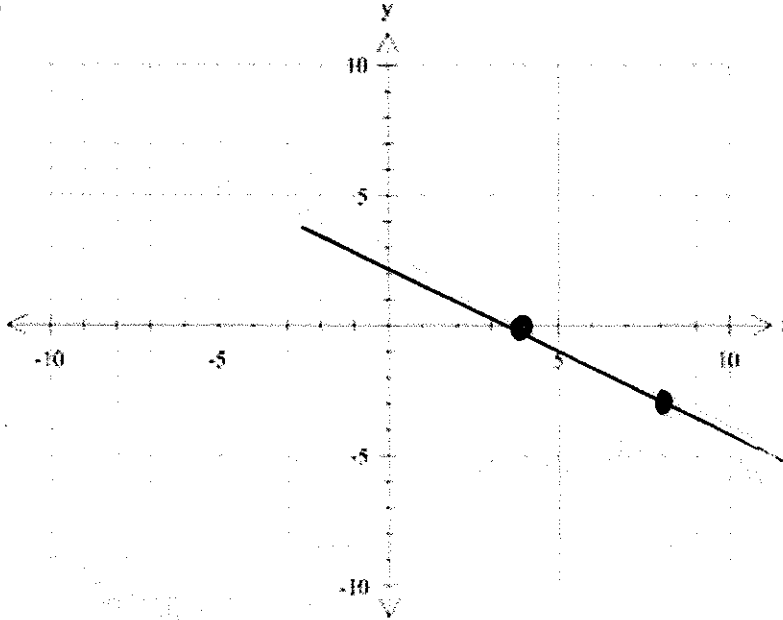
Graph each of the following linear functions by creating a table of values and determining the coordinates of two points.

$$3x + 4y = 12 - 3x$$

x	y
4	0
8	-3

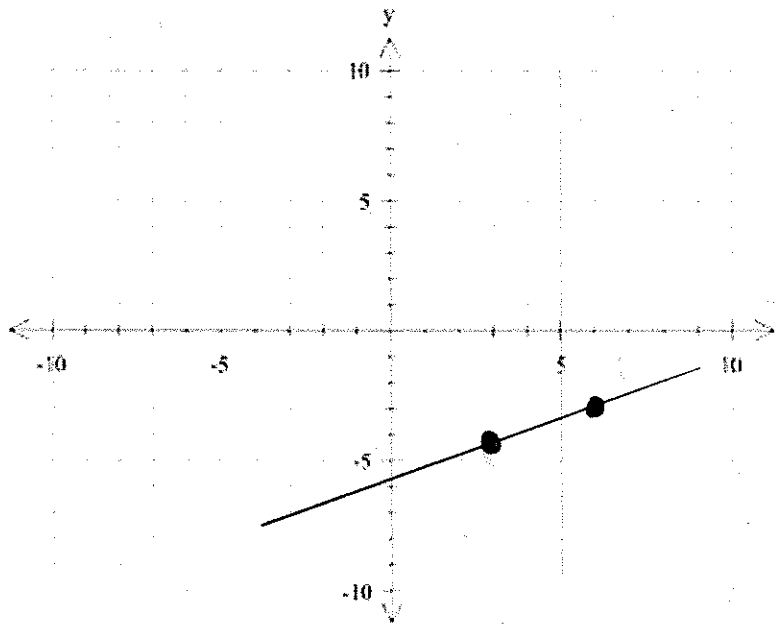
$$\frac{4y}{4} = \frac{-3x + 12}{4}$$

$$y = -\frac{3}{4}x + 3$$



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

x	y
3	-4
6	-3





Name: _____

Math 4 CST



Midterm Review

Jeff, Andy and Joe like to play darts. The following table shows the points received already in the yellow section and the amount of darts that landed in the other coloured sections of the dart board.

player	colour			Total points
	Black section	Red section	Yellow section	
Jeff	3 darts	7 darts	10 points -10	175 -10 = 165
Andy	5 darts	8 darts	5 points -5	225 -5 = 220
Joe	4 darts	6 darts	15 points	?

$x = \text{Black}$
 $y = \text{Red}$

How many total points did Joe score?

$$\text{Jeff: } 3x + 7y = 165 \quad \text{Andy: } 5x + 8y = 220$$

$$\begin{array}{l} \textcircled{1} \quad 5(3x + 7y = 165) \\ \quad -3(5x + 8y = 220) \end{array} \left| \begin{array}{l} 15x + 35y = 825 \\ -15x - 24y = -660 \\ \hline 11y = 165 \\ \hline y = 15 \end{array} \right.$$

$$\begin{array}{l} \textcircled{2} (x): \quad 3x + 7y = 165 \\ \quad 3x + 7(15) = 165 \\ \quad 3x + 105 = 165 \\ \quad -105 \quad -105 \\ \hline 3x = 60 \\ \quad 3 \quad 3 \\ \hline x = 20 \end{array}$$

$$\textcircled{3} \text{ Joe: } 4x + 6y + 15 = ?$$

$$4(20) + 6(15) + 15 = ?$$

$$80 + 90 + 15 = 185$$

$$\underline{\text{Joe's total points} = 185}$$



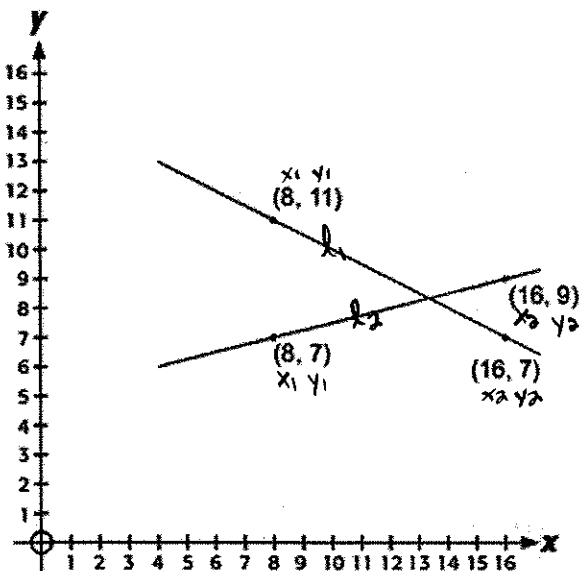
Name: _____

Math 4 CST



Midterm Review

A system of equations is graphed on the Cartesian plane below. Solve this system of equations.



$$\textcircled{1} l_1: a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 11}{16 - 8} = \frac{-4}{8} = -\frac{1}{2} \text{ or } -0.5$$

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

$$\textcircled{ii} = -\frac{1}{2}(8) + b \quad y = -\frac{1}{2}x + 15$$

$$11 = -4 + b$$

$$+4 \quad +4$$

$$\boxed{b = 15}$$

$$\textcircled{2} l_2: a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{9 - 7}{16 - 8} = \frac{2}{8} = \frac{1}{4} \text{ or } 0.25$$

$$y = \frac{1}{4}x + b$$

$$\textcircled{ii} = \frac{1}{4}(8) + b$$

$$y = \frac{1}{4}x + 5$$

$$7 = 2 + b$$

$$-2 \quad -2$$

$$\boxed{b = 5}$$

$$\text{POI: } \begin{cases} y = -0.5x + 15 \\ y = 0.25x + 5 \end{cases}$$

$$-0.5x + 15 = 0.25x + 5$$

$$-0.25x \quad -15 \quad -0.25x \quad -15$$

$$\frac{-0.75x}{-0.75} = \frac{-10}{-0.75}$$

$$\boxed{x = 13.33}$$

$$(y): y = 0.25x + 5$$

$$y = 0.25(13.33) + 5$$

$$y = 3.33 + 5$$

$$\boxed{y = 8.33}$$

$$\text{POI: } (13.33, 8.33)$$



Name: _____

Math 4 CST



Midterm Review

Solve the equation by isolating the variable.

$$1.) \quad 5x + \cancel{7} = 22 \quad -7$$

$$\frac{\cancel{5}x}{8} = \frac{15}{5}$$

$$\boxed{x=3}$$

$$2.) \quad -3x - \cancel{4} = 11 \quad +4$$

$$\frac{-\cancel{3}x}{-3} = \frac{15}{-3}$$

$$\boxed{x=-5}$$

$$3.) \quad \frac{x}{4} + \cancel{7} = 12 \quad -7$$

$$\frac{1}{4}x = 5$$

$$\frac{\cancel{0.25}x}{\cancel{0.25}} = \frac{5}{0.25}$$

$$\boxed{x=20}$$



Name: _____

Math 4 CST



Midterm Review

Solve the equation by isolating the variable.

$$1.) \quad 0.4x - \cancel{3} = 7 + 3$$

$$\begin{array}{r} 0.4x = 10 \\ \hline 0.4 \quad 0.4 \\ \hline \boxed{x = 25} \end{array}$$

$$2.) \quad \cancel{8} - 2x = 12 - 8$$

$$\begin{array}{r} -2x = 4 \\ \hline -2 \quad -2 \\ \hline \boxed{x = -2} \end{array}$$

$$3.) \quad \cancel{7} - x = 14 - 7$$

$$\begin{array}{r} -x = 7 \\ \hline -1 \quad -1 \\ \hline \boxed{x = -7} \end{array}$$



Name: _____

Math 4 CST



Midterm Review

Solve the equation by isolating the variable.

$$1.) \frac{2x-4}{6} = \frac{3}{1} \begin{matrix} \times 6 \\ \times 6 \end{matrix}$$

~~$$\frac{2x-4}{6} = \frac{18}{6}$$~~

~~$$2x - 4 = 18$$~~

$$\begin{matrix} +4 & +4 \end{matrix}$$

~~$$2x = 22$$~~

$$\begin{matrix} \div 2 & \div 2 \end{matrix}$$

$$\boxed{x = 11}$$

$$2.) \begin{matrix} 5m & - & 8 & = & 7m & - & 2 \\ -7m & & +8 & & -7m & & +8 \end{matrix}$$

~~$$-2m = 6$$~~

$$\begin{matrix} -2 & -2 \end{matrix}$$

$$\boxed{m = -3}$$



Name: _____

Math 4 CST



Midterm Review

Solve the equation by isolating the variable.

$$1.) \quad 5k = 7 - 11k - 13$$

$\begin{array}{c} +11k \\ \hline \end{array}$
 $\begin{array}{c} -11k \\ \hline \end{array}$

$$\frac{16k}{16} = \frac{-6}{16}$$

$$\boxed{k = -0.38}$$

$$2.) \quad 5 + 8y - 14 = y + 5 + 14$$

$\begin{array}{c} -5 \\ \hline \end{array}$
 $\begin{array}{c} -y \\ \hline \end{array}$
 $\begin{array}{c} +14 \\ \hline \end{array}$
 $\begin{array}{c} -y \\ \hline \end{array}$
 $\begin{array}{c} -5 \\ \hline \end{array}$

$$\frac{7y}{7} = \frac{14}{7}$$

$$\boxed{y = 2}$$



Name: _____

Math 4 CST



Midterm Review

The grade 11 girls are trying to raise money for their graduation dance. It has been a tradition to sell handmade bracelets and necklaces to raise funds. Two years ago the girls sold 23 bracelets and 19 necklaces for a profit of \$179.25. Last year the girls sold 27 bracelets and 18 necklaces for a profit of \$186.75. This year the girls have made 30 bracelets and 25 necklaces. How much money will the raise if they sell all their jewelry?

 $x = \text{bracelets}$ $y = \text{necklaces}$

$$\text{years ago: } 23x + 19y = 179.25$$

$$\text{Last year: } 27x + 18y = 186.75$$

$$\text{this year: } 30x + 25y = ?$$

$$\begin{array}{r|l} \textcircled{1} & 27(23x + 19y = 179.25) \\ & -23(27x + 18y = 186.75) \\ \hline & 621x + 513y = 4839.75 \\ & -621x - 414y = -4295.25 \\ \hline & 99y = 544.50 \\ & \frac{99y}{99} = \frac{544.50}{99} \end{array}$$

$$\boxed{y = 5.50}$$

$$\textcircled{2} \quad 23x + 19y = 179.25$$

$$23x + 19(5.50) = 179.25$$

$$\begin{array}{r} 23x + 104.50 = 179.25 \\ -104.50 \quad -104.50 \\ \hline 23x = 74.75 \\ \frac{23x}{23} = \frac{74.75}{23} \end{array}$$

$$\boxed{x = 3.25}$$

$$\textcircled{3} \quad 30x + 25y = ?$$

$$30(3.25) + 25(5.50) =$$

$$97.50 + 137.50 = \boxed{235}$$

They will raise \$235



Name: _____

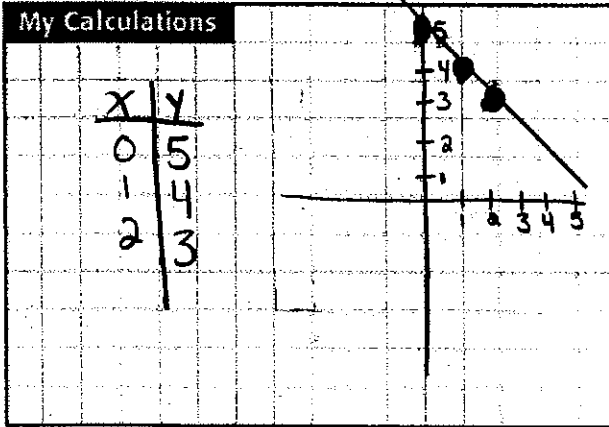
Math 4 CST



Midterm Review

Graph

$$y = -x + 5$$





Name: _____

Math 4 CST

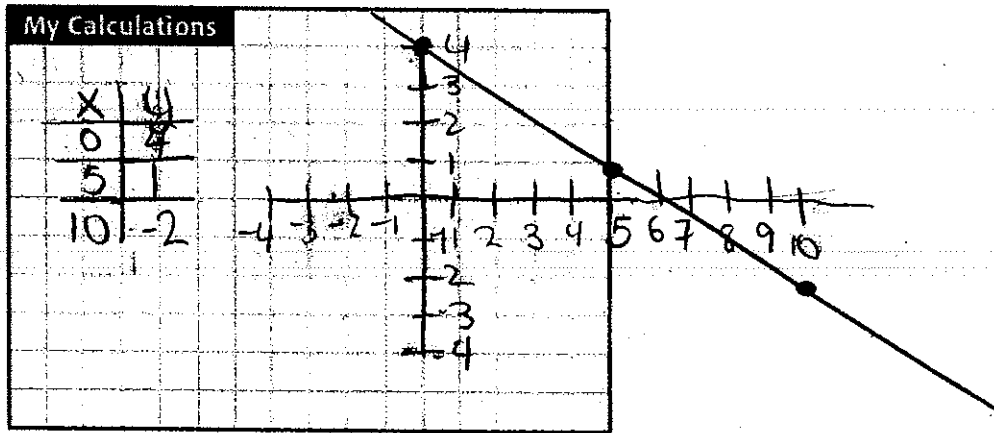


Midterm Review

Graph.

$$y = -\frac{3}{5}x + 4$$

x	y
0	4
5	1
10	-2



$$y = -\frac{3}{5}(0) + 4$$

$$y = 4$$

$$y = -\frac{3}{5}(5) + 4$$

$$y = 1$$

$$y = -\frac{3}{5}(10) + 4$$

$$y = -2$$



Name: _____

Math 4 CST



Midterm Review

The equation of line ℓ is $6x - 3y + 2 = 0$. Which of the equations given below is perpendicular to line ℓ ?

a) $y = \frac{1}{2}x$

b) $y = -\frac{1}{2}x$

c) $y = 2x$

d) $y = -2x$

$$\begin{array}{r} 6x - 3y + 2 = 0 \\ -6x \quad -2 \end{array}$$

$$\frac{-3y}{-3} = \frac{-6x - 2}{-3}$$

$$y = +2x$$

↓
perpendicular: $y = -\frac{1}{2}x$



Name: _____

Math 4 CST



Midterm Review

Last weekend, Colin, Ankur and Erin took their families out to the same restaurant. The restaurant had a set menu that night and there were two options for dinner. Guests could either order a Pasta meal or a Surf & Turf meal.

After dinner the waiter brought the bill to each of the tables, but the waiter forgot to mark in the total for Erin's table (the totals include the taxes).

Colin's Table
 4 Seafood Meals (x)
 3 Surf & Turf Meals (y)
 Total: \$111

Ankur's Table
 5 Seafood Meals
 4 Surf & Turf Meals
 Total: \$143

Erin's Table
 6 Seafood Meals
 6 Surf & Turf Meals
 Total: _____

$$\begin{array}{l} \text{Colin: } 4x + 3y = 111 \\ \text{Ankur: } 5x + 4y = 143 \end{array} \left\} \begin{array}{l} 5(4x + 3y = 111) \\ -4(5x + 4y = 143) \end{array} \right| \begin{array}{l} 20x + 15y = 555 \\ -20x - 16y = -572 \\ \hline -y = -17 \\ \hline y = 17 \end{array}$$

$x = ?$

$$\begin{array}{r} 5x + 4y = 143 \\ 5x + 4(17) = 143 \\ 5x + 68 = 143 \\ -68 \quad -68 \\ \hline 5x = 75 \\ \hline x = 15 \end{array}$$

Erin's table (total cost)

$$\begin{array}{l} 6x + 6y = ? \\ 6(15) + 6(17) = \\ 90 + 102 = \boxed{192} \end{array}$$

\$192



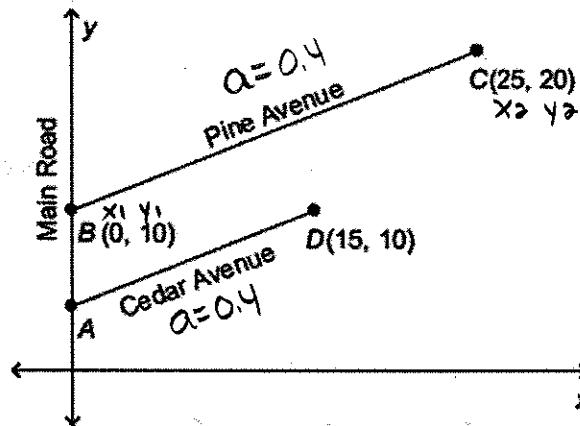
Name: _____

Math 4 CST



Midterm Review

In the diagram show below, Pine Avenue (\overline{BC}) is parallel to Cedar Avenue (\overline{AD}). Pine Avenue meets Main Road at point B and Cedar Avenue meets Main Road at point A. What is the length of Cedar Avenue to the nearest tenth of a unit?



① Slope of \overline{BC} : $a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{20 - 10}{25 - 0} = \frac{10}{25} = \boxed{0.4}$

② coordinate A: ③ $y = 0.4x + b$
 $(10) = 0.4(15) + b$
 $10 = 6 + b$
 $-6 \quad -6$
 $\boxed{b = 4}$

④ A (y-int)
 \downarrow
 $(0, 4)$

distance of Cedar Avenue

$$d = \sqrt{(15 - 0)^2 + (10 - 4)^2}$$

$$d = \sqrt{225 + 36}$$

$$d = \sqrt{261}$$

$$d = 16.15 \text{ units}$$



Name: _____

Math 4 CST



Midterm Review

Charles wants to buy a cell phone. The Norris Cellular Phone Company charges \$35 per month plus \$0.05 per minute. The Benwell Cellular Phone Company charges \$25 per month and \$0.10 per minute.

When Charles looked at the number of minutes he used last month on his old cell phone, he realized that he would have wound up paying the same amount with each of the two companies.

How many minutes per month did Charles use his phone last year?

$$\text{Norris: } y = 0.05x + 35$$

$$\text{Benwell: } y = 0.10x + 25$$

$$\begin{array}{r} 0.05x + 35 = 0.10x + 25 \\ -0.10x \quad -35 \quad -0.10x \quad -35 \\ \hline \end{array}$$

$$\begin{array}{r} -0.05x = -10 \\ \hline -0.05 \quad -0.05 \\ \hline \end{array}$$

$$x = 200 \text{ minutes per month}$$

200 minutes



Name: _____

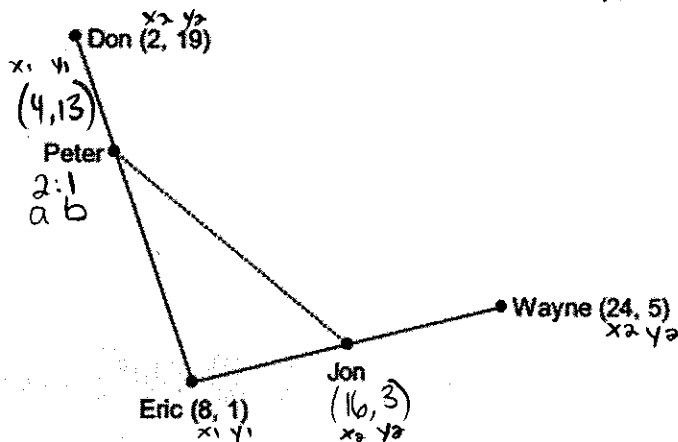
Math 4 CST



Midterm Review

Five friends each have a cottage as shown on the map below. The map, that is scaled in kilometres, shows the cottage's locations (the ordered pairs indicate the coordinates of each cottage) and the roads connecting them. Peter's cottage is twice as far from Eric's cottage as it is from Don's cottage. Jon's cottage is exactly halfway between Eric's cottage and Wayne's cottage.

If Peter and Jon connect their cottages with a straight road, how long would that road be in kilometres?

Peter: $\frac{2}{3} \rightarrow 2:1$ 

$$\textcircled{1} \text{ Jon: } M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$M = \left(\frac{8 + 24}{2}, \frac{1 + 5}{2} \right)$$

$$M = \left(\frac{32}{2}, \frac{6}{2} \right)$$

$$\boxed{M = (16, 3)}$$

$$\textcircled{2} \text{ Peter: } P(x_p, y_p) = \left(\frac{ax_2 + bx_1}{a+b}, \frac{ay_2 + by_1}{a+b} \right)$$

$$P = \left(\frac{2(2) + 1(8)}{2+1}, \frac{2(19) + 1(1)}{2+1} \right)$$

$$P = \left(\frac{4+8}{3}, \frac{38+1}{3} \right)$$

$$P = \left(\frac{12}{3}, \frac{39}{3} \right)$$

$$\boxed{P = (4, 13)}$$

$$\textcircled{3} d(P, J) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(16 - 4)^2 + (3 - 13)^2}$$

$$d = \sqrt{(12)^2 + (-10)^2}$$

$$d = \sqrt{144 + 100}$$

$$d = \sqrt{244}$$

$$\boxed{d = 15.62}$$

The road will be 15.62 km long



Name: _____



Midterm Review

The equations of two linear functions are shown below.

$$y_1 = 3x$$

$$y_2 = -3x$$

perp of $y_1 \rightarrow 3 = -1/3$

Which one of the following statements is true?

- a) The two lines are parallel and never intersect.
- b) The two lines intersect, but are not perpendicular.
- c) The two lines are perpendicular.
- d) These two equations are parallel and coincident.

David receives a base salary of \$350 and earns \$15 for every scooter he sells. Sheila works for the same company and her salary is represented by the following equation:

$y_s = 250 + 25x$

x : total scooters sold
 y_s : total salary for Sheila

David: $y = 15x + 350$
 Sheila: $y = 25x + 250$

After how many sales will their total salaries be the same?

- a) They both need to sell 500 scooters.
- b) David's total salary will always be more than Sheila's.
- c) They both need to sell 10 scooters.
- d) Sheila's total salary will always be more than David's.

$$15x + 350 = 25x + 250$$

$$-25x - 350 \quad -25x - 350$$

$$\frac{-10x = -100}{-10 \quad -10}$$

$$\boxed{x = 10}$$



Name: _____

Math 4 CST



Midterm Review

Macrohard Software and Computers Inc. has been manufacturing processors since 1982. They estimate that the speed of their top processor has increased by 15% every year. On January 1, 1982, the speed of their top processor was 60 MHz. This situation is represented by the rule given below:

$$F(x) = 60(1.15)^x$$

x : # of years since January 1, 1982

$F(x)$: Speed of the top processor

$$2012 - 1982 = 30 \text{ years} \quad (x)$$

$$\uparrow 15\% = 1 + \frac{15}{100} = 1.15$$

What will the speed of the company's top processor be on January 1, 2012?

$$F(x) = 60(1.15)^{30}$$

$$F(x) = 3,972.70$$

3,972.70 MHz



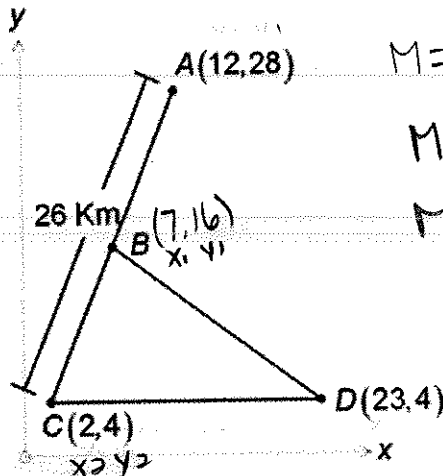
Name: _____

Math 4 CST



Midterm Review

In the coordinate plane below (scale is in kilometres), line segments AC , CD and BD represent horseback riding trails. Each letter represents a barn. Barn B is located halfway between barn A and barn C . The trail connecting barn A to barn C is 26 Km long.



$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

$$M = \left(\frac{12 + 2}{2}, \frac{28 + 4}{2} \right)$$

$$M = \left(\frac{14}{2}, \frac{32}{2} \right)$$

$$M = (7, 16)$$

If Melissa set off on her horse from barn C , rode to barn D , then to barn B , and then back to barn C , how far did she ride?

$$d(C, D) + d(D, B) + d(B, C) = \text{total distance}$$

$$(21) + (20) + (13) = 54 \text{ Km}$$

$$\textcircled{2} d(C, D) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$d = \sqrt{(23 - 2)^2 + (4 - 4)^2}$$

$$d = \sqrt{(21)^2 + (0)^2}$$

$$d = \sqrt{441}$$

$$d = 21$$

$$\textcircled{3} d(D, B) =$$

$$d = \sqrt{(7 - 23)^2 + (16 - 4)^2}$$

$$d = \sqrt{(-16)^2 + (12)^2}$$

$$d = \sqrt{256 + 144}$$

$$d = \sqrt{400}$$

$$d = 20$$

$$\textcircled{4} d(B, C) =$$

$$d = \sqrt{(2 - 7)^2 + (4 - 16)^2}$$

$$d = \sqrt{(-5)^2 + (-12)^2}$$

$$d = \sqrt{25 + 144}$$

$$d = \sqrt{169}$$

$$d = 13$$

Melissa travelled 54 Km



Name: _____

Math 4 CST



Midterm Review

At Winter Carnival last year, the students at Westwood Senior High School bought hats and scarves and made a profit reselling them. The following table shows the profit earned by the students in grade 10 and grade 11.

	# of hats sold	# of scarves sold	Profit
Grade 10	60	50	\$390
Grade 11	80	40	\$440

x: cost per hat

y: cost per scarf

What will the profit be for the grade 9 students if they sell 75 hats and 55 scarves?

$$\begin{array}{r} \textcircled{1} \quad 4(60x + 50y = 390) \\ -3(80x + 40y = 440) \\ \hline 240x + 200y = 1560 \\ -240x - 120y = -1320 \\ \hline 80y = 240 \\ 80 \quad 80 \\ \hline y = 3 \end{array}$$

$$\begin{array}{r} \textcircled{2} \quad 60x + 50y = 390 \\ 60x + 50(3) = 390 \\ 60x + 150 = 390 \\ -150 \quad -150 \\ \hline 60x = 240 \\ 60 \quad 60 \\ \hline x = 4 \end{array}$$

③ Grade 9 students



$$75x + 55y = \text{total profit}$$

$$75(4) + 55(3) =$$

$$300 + 165 = \boxed{\$465}$$

$$x (\$ \text{ per hat}) = 4$$

$$y (\$ \text{ per scarf}) = 3$$

$$\boxed{x = 4}$$

The grade 9 students will have a total profit of $\$465$



Name: _____



Midterm Review

Determine the slope of a line whose

- x-intercept is -2 and y-intercept is -4.

$$\begin{matrix} (-2, 0) \\ x_1 & y_1 \end{matrix}$$

$$\begin{matrix} (0, -4) \\ x_2 & y_2 \end{matrix}$$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - 0}{0 - (-2)} = \frac{-4}{2} = \boxed{-2}$$

$$\underline{\underline{-2}}$$

Determine the equation of a line whose

- x-intercept is 4 and y-intercept is 2. (b=2)

$$\begin{matrix} (4, 0) \\ x_1 & y_1 \end{matrix}$$

$$\begin{matrix} (0, 2) \\ x_2 & y_2 \end{matrix}$$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{0 - 4} = \frac{2}{-4} = \boxed{-0.5}$$

$$\underline{\underline{y = -0.5x + 2}}$$

Determine the equation of a line whose

- x-intercept is 8 and y-intercept is 10. (b=10)

$$\begin{matrix} (8, 0) \\ x_1 & y_1 \end{matrix}$$

$$\begin{matrix} (0, 10) \\ x_2 & y_2 \end{matrix}$$

$$a = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 0}{0 - 8} = \frac{10}{-8} = \boxed{-1.25}$$

$$\underline{\underline{y = -1.25x + 10}}$$