MATH 1730 EXAM I

(Version 1)

100 points

NAME:_____

Please place the letter of your selection in the blank provided. These questions are worth five points each.

5 pts 1. ____**D**_____ When we use the term "quantity" in this course, what do we mean?

(a) Any object or process is a quantity.

(b) Only an object or process that changes is a quantity.

(c) Only an object or process that can be observed or touched is a quantity.

(d) Any attribute of an object or a process that can be measured is a quantity.

(e) Only attributes of an object or process that involve dimensions (like length or width) are quantities.

5 pts 2. ____**D**_____ When defining a variable to represent the values of a changing quantity, which of the following questions should we always try to answer?

I What is the attribute we are measuring?

II What units of measure will we be using?

III Where or when do we start measuring?

(a) Only Statement I is important.

(b) Only Statement II is important.

(c) Only Statements II and III are important.

(d) All three Statements are important.

(e) None of these Statemets is important.

5 pts 3. ____**D**_____ Mavis opens the drain on a bathtub full of water and watches as the water drains away. Which of the following is a changing quantity in this scenario?

(a) the water in the tub

(b) the total time in minutes that it takes to drain the tub

(c) the volume of water in gallons remaining in the tub when it is half full

(d) the weight of the water in pounds that remains in the tub since the drain was opened

(e) All of the above are varying quantities.

Justification. Since the action of draining the tub only happens once, the only quantities that vary will be those that *change during the process of draining the tub.* Quantities that measure totals for any snapshot taken during the process will be constant.

5 pts 4. ____**C**_____ Branson jogs four laps around a 500 meter track. Which of the following is a constant quantity in this scenario?

(a) the distance in feet around the track Branson has traveled since beginning his jog

(b) the number of laps Branson has run since beginning his jog

(c) the total time in minutes it takes for Branson to complete his jog

(d) the distance in feet remaining in Branson's jog since he started jogging

(e) the number of seconds passed since Branson began his jog

5 pts 5. **C** Dharma starts eating a bowl of soup at noon and finishes one hour later. Which of the following statements would correctly define a *variable* for this scenario?

(a) Let T be the total time in seconds since noon it takes Dharma to eat the soup.

(b) Let T be time.

(c) Let T be the number of minutes remaining until Dharma finishes her soup.

(d) Let T be the time it takes Dharma to eat half of her soup.

(e) Let T be the total time in minutes that pass between Dharma starting and finishing her soup.

5 pts 6. **A** Suppose that a and b are variables in a linear relationship. If the change in b is always 4.6 times the change in a, which of the following statements is true?

(a) $\Delta b = 4.6\Delta a$ (b) $\Delta a = 4.6\Delta b$

(c) $a = 4.6b$ (d) $b = 4.6a$

(e) $\dfrac{b}{a} = 4.6$

Justification. It is *possible* that $b = 4.6a$ as well, but not enough information is given to determine this. The formula in (a) is the only one we can be certain is true.

5 pts 7. **E** Suppose the volume of water in a bathtub decreases by 500 cubic inches for every minute that passes since the tub drain is opened. Let V represent the the volume of water in cubic inches, and let t represent the number of minutes that have passed (both since the tub drain is opened). Which formula gives the value of ΔV with respect to the value of Δt?

(a) $\Delta V = -500$ (b) $V = 500$

(c) $\Delta V = -500t$ (d) $500\Delta V = \Delta t$

(e) $\Delta V = -500\Delta t$

5 pts 8. **B** When Lindsay is ten feet from her house, she starts walking at a constant rate of twenty feet every three seconds. If we let d represent Lindsay's distance in feet from home and let t represent the number of seconds passed since she started walking at a constant speed, which of the following formulas gives the values of d in terms of the values of t?

(a) $d = \dfrac{20}{3}t$ (b) $d = \dfrac{20}{3}t + 10$

(c) $\Delta d = 6.67\Delta t$ (d) $t = 0.15d$

(e) $t = 10d + 6.67\Delta d$

5 pts 9. **B** Suppose that x and y are variables in a linear relationship. The equation $\dfrac{\Delta y}{\Delta x} = -\dfrac{3}{2}$ means

(a) When $x = 2$, then $y = -3$.

(b) For every increase of 2 in the value of x, there is a decrease of 3 in the value of y.

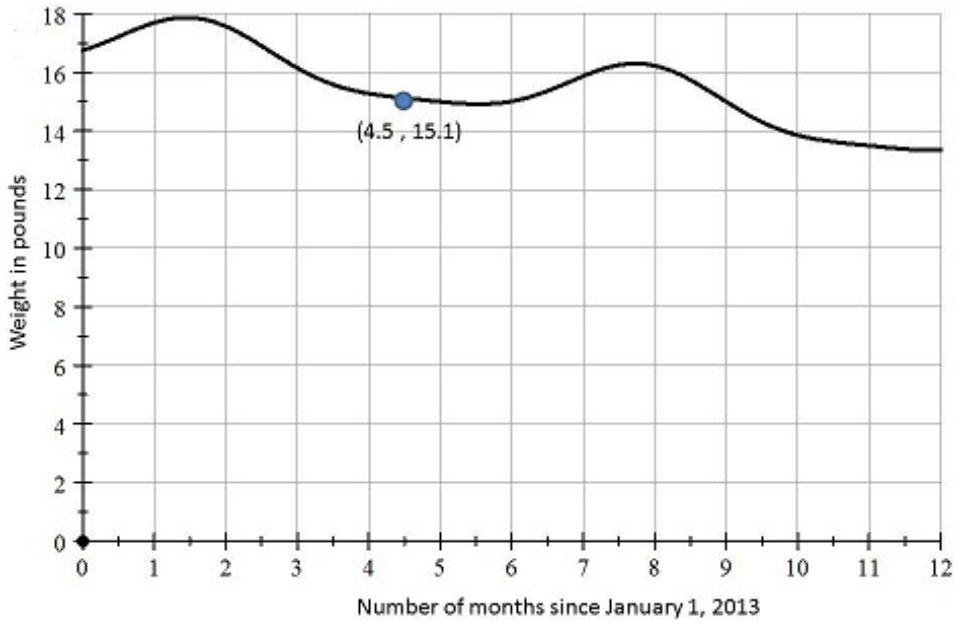
(c) The y-intercept of the graph must be the point $(-2, 3)$ or the point $(2, -3)$.

(d) If we move three units up and two units left, we must cross the y-axis.

(e) None of Statements (a), (b), (c) or (d) is true.

Justification. The ratio above tells us "We always have $\Delta x = 2$ whenever $\Delta y = -3$, and we always have $\Delta x = -2$ whenever $\Delta y = 3$." The first statement is represented by Option (b). The second statement does not appear as an option.

Problems 10 and 11 refer to the graph below, which shows the relationship between the weight W in pounds of Milton's cat, Murgatroyd, and the number m of months since Milton started using a new cat food on January 1, 2013.



5 pts 10. **B** What is the meaning of the point $(4.5, 15.1)$ on the graph above?

(a) Fifteen and one-tenth months after January 1, 2013, Murgatroyd's weight was four and one-half pounds.

(b) Four and one-half months after January 1, 2013, Murgatroyd's weight was fifteen and one-tenth pounds.

(c) There was a change of fifteen and one-tenth pounds as the number of months since January 1, 2013 changed from 0 to 4.5.

(d) There was a change of four and one-half months as Murgatroyd's weight changed by fifteen and one-tenth pounds.

(e) It took Murgatroyd four and one-half months to lose fifteen and one-tenth pounds.

5 pts 11. **E** As the value of m increases from 3 to 10 months, what is the approximate value of ΔW?.

(a) $\Delta W = -1.2$ pounds (b) $\Delta W = 16$ pounds

(c) $\Delta W = 10$ pounds (d) $\Delta W = 0$ pounds

(e) $\Delta W = -2$ pounds

5 pts 12. **D** Suppose that u and v are variables in a linear relationship, and $v = -3.7u + 10$ is the formula that expresses v in terms of u. Which of the following statements is true?

(a) The graph of this relationship never crosses the u-axis or the v-axis.

(b) The graph of this relationship crosses the u-axis at the point $(-3.7, 10)$.

(c) The graph of this relationship crosses the v-axis at the point $(-3.7, 10)$.

(d) The graph of this relationship crosses the u-axis at the point $(0, 10)$.

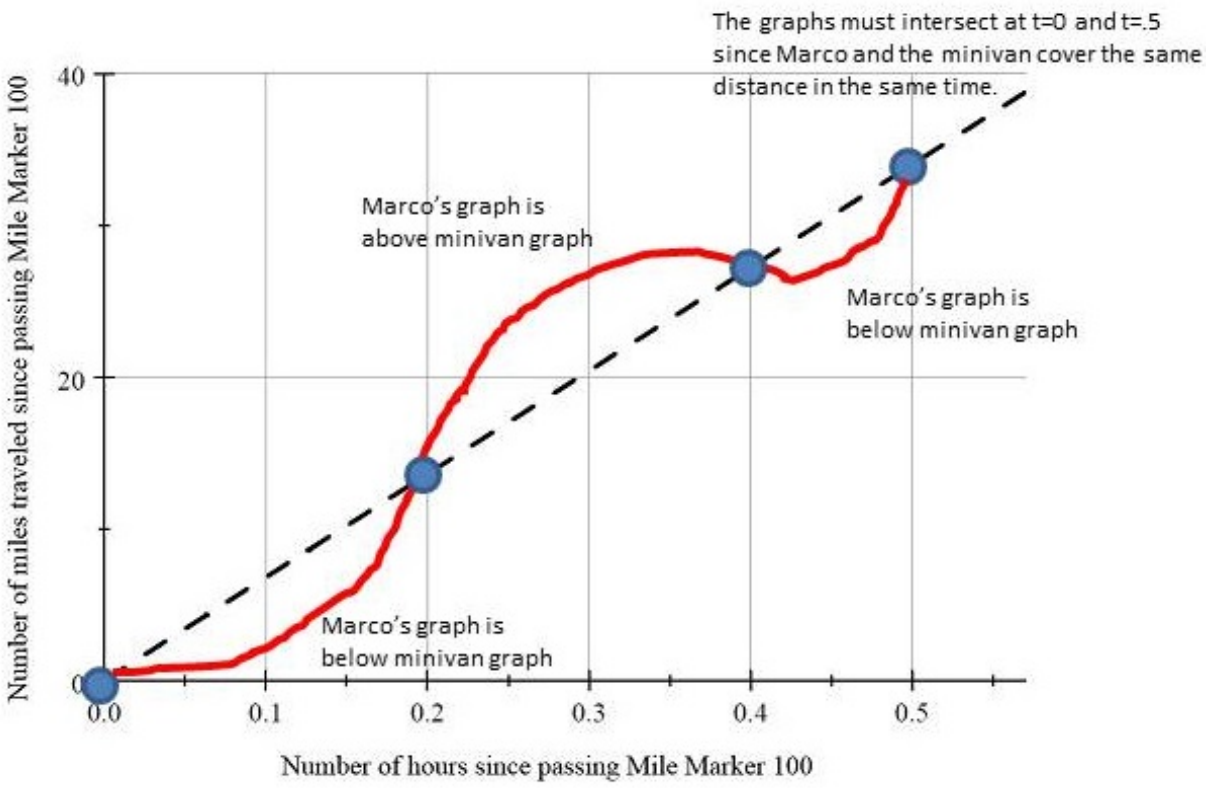
(e) The graph of this relationship crosses the v-axis at the point $(0, 10)$.

Justification. The graph of a linear relationship is a straight line, and a straight line will always cross at least one of the two axes. (Note that the vertical axis represents the values of u, since the formula gives the values of u in terms of the values of v.) The vertical intercept for this line will therefore occur when $v = 0$; that is, at the point $(0, 10)$. This point will lie on the u-axis.

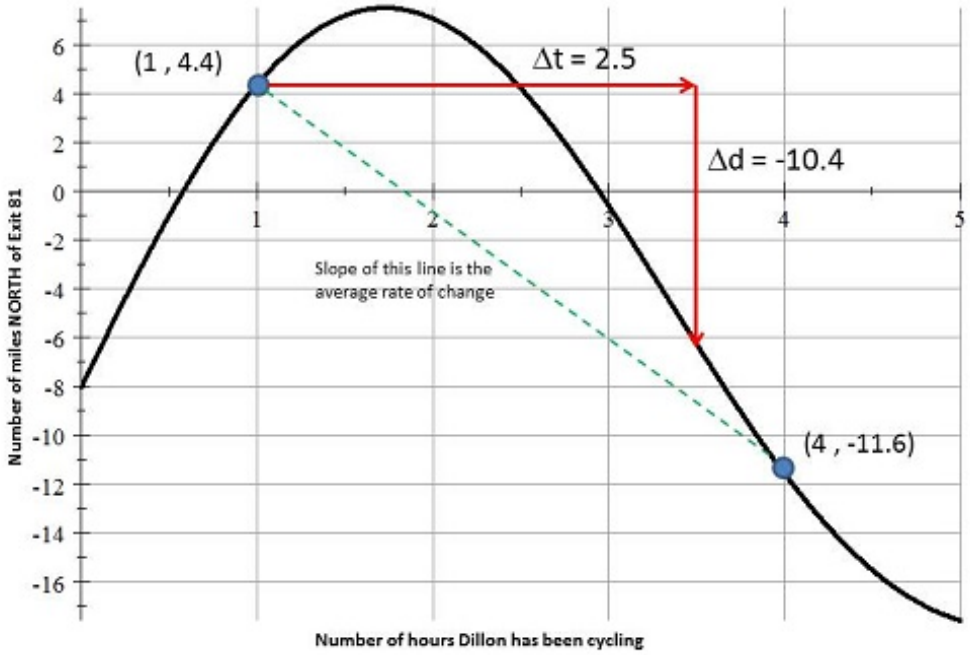
10 pts 13. Between Mile Markers 100 and 134 on Interstate 40, Marco traveled at an average speed of 32.3 miles per hour. The diagram below shows the distance versus time graph for a minivan traveling at Marco's average speed between these markers. On the same grid, sketch a possible distance-versus-time graph for Marco if we know all of the following happened during the trip.

- The minivan passed Marco at MM 100, and
- Marco passed the minivan 0.2 hours after they both passed MM 100, and
- The minivan passed Marco again 0.4 hours after they both passed MM 100.

Remember, the dashed line below is the distance-versus-time graph for the *minivan*.



14. The graph below shows Dillon's distance-versus-time graph for a five hour period when he was riding his bicycle on the shoulder of Interstate 24. Let t represent the number of hours Dillon has been cycling, and let d represent the number of miles Dillon is north of Exit 81.



5 pts (a) Was Dillon north or south of Exit 81 when he started cycling? How do you know?

Solution. Dillon started cycling when $t = 0$ hours. According to the graph, Dillon was $d = -8$ miles north of Exit 81. We would interpret this to mean that Dillon was eight miles *south* of Exit 81 when he started cycling.

5 pts (b) What is the meaning of the point $(4, -11.6)$ on this graph?

Solution. When four hours had passed since Dillon started cycling, he was 11.6 miles *south* of Exit 81.

5 pts (c) Starting at the point $(1, 4.4)$ represent "an increase of 2.5 hours" on the graph.

Solution. See graph above.

5 pts (d) What is the corresponding change in the number of miles north of Exit 81? Represent this change on the graph.

Solution. We see from the graph that Dillon moves FROM the point $(1, 4.4)$ TO the point $(3.5, -6)$. Therefore, the change in Dillon's distance from Exit 81 will be

$$\Delta d = -6 - 4.4 = -10.4 \text{ miles}$$

10 pts (e) What is Dillon's average speed on the time interval $t = 1$ to $t = 4$ hours? You must show your steps for full credit.

Solution. As the values of t increase from $t = 1$ to $t = 4$ hours, we know that $\Delta t = 4 - 1 = 3$ hours. Now, the corresponding change in the values of d will be $\Delta d = -11.6 - 4.4 = -16$ miles. Therefore, Dillon's average speed on this time interval will be

$$\frac{\Delta d}{\Delta t} = -\frac{16}{3} \text{ miles per hour}$$