

Outcomes Assessment at Montgomery College

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Ma 180 OUTCOMES TEST QUESTIONS
Fall, 2006

1. Given the equation $\cos(2\theta) - \sin(\theta) = 0$, for $0 \leq \theta \leq 2\pi$, do EACH of parts (a), (b), and (c).

(a) Solve the equation **algebraically**.

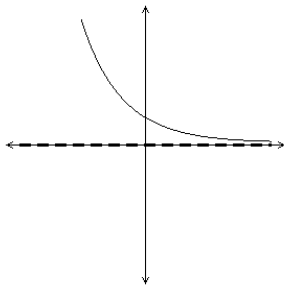
(b) Use your graphing calculator to determine each solution of the given equation on the specified domain. If necessary, round your answer to the nearest four decimal places.

(c) Graph the relationship described in the given equation on the specified domain. On the graph, mark and label the location of each solution, including its coordinates.

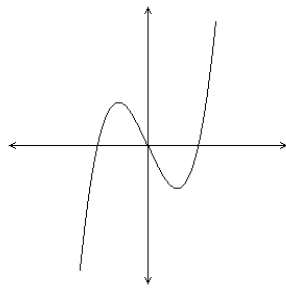


2. Four functions are graphed below and a list of function types is at the right. For each graph, select the name of its FUNCTION TYPE and write it in the space below graph.

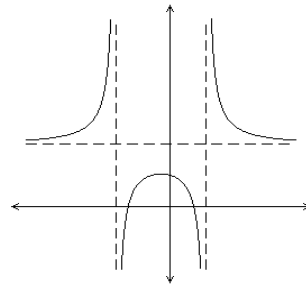
FUNCTION TYPE
exponential
logarithmic
polynomial
rational
sinusoidal
none of the above



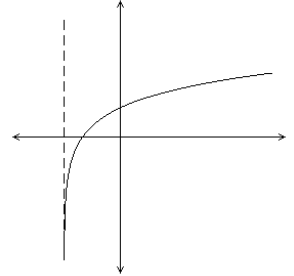
a) _____



b) _____



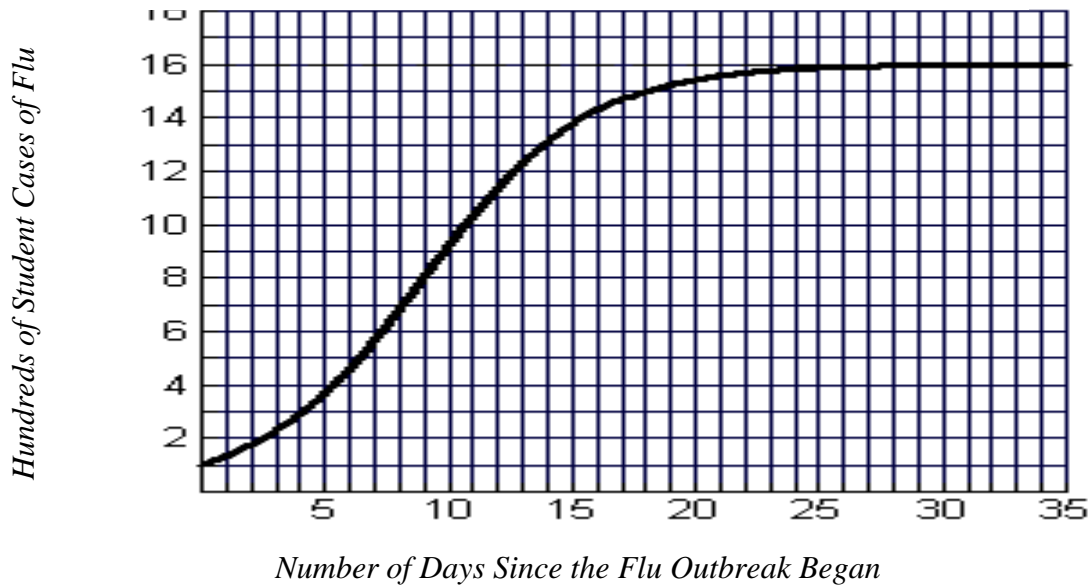
c) _____



d) _____

3. There was a flu epidemic at State University. The graph below shows the total number of cases of flu, as reported by the Student Health Center during the epidemic. Use the graph to answer the questions below, based on the Student Health Center data.

Total Cases of Flu during an Epidemic at State University



- (a) About how many students had the flu when the outbreak began? a) _____
- (b) About how many students had the flu on the sixth day of the flu outbreak? b) _____
- (c) How long did it take for 1300 students to come down with the flu, once the outbreak began? c) _____
- (d) During which five-day span were there more new cases of the flu between day 5 and day 10 or between day 15 and day 20? d) _____

Justify your answer, using complete sentence(s).

- (e) Estimate the average rate of change in the flu cases between day 5 and day 10. e) _____
- (f) On which of these days are the flu cases increasing the fastest? Day 2, day 4, day 8, day 16 or day 32? f) _____
- (g) What does the graph suggest is the total number of cases of flu during this epidemic? g) _____

Outcomes Assessment Results
(Limited to the 351 students who completed at least one of the OA items)

The following table presents student performance by final grade for each of the three questions comprising the outcomes assessment: (1) solving a trigonometric equation; (2) identifying graphs; and (3) reasoning from graphically presented data. Scores for Items 1 and 3 are the sum of points earned for specific aspects of the task. Similar statistics for each of them are presented in the Appendix.

			Count	Mean	Median	Mode	Max	Min
Final Grade	A	Solving a Trig Equation	84	6.06	6	5	10	0
		Identify Graphs	84	3.23	3	4	4	1
		Reasoning from Graphic Data	84	8.77	9	10	10	4
	B	Solving a Trig Equation	113	4.92	5	0	10	0
		Identify Graphs	113	2.84	3	4	4	0
		Reasoning from Graphic Data	113	7.98	9	9	10	0
	C	Solving a Trig Equation	81	2.69	2	0	10	0
		Identify Graphs	81	2.72	3	4	4	0
		Reasoning from Graphic Data	81	7.93	9	10	10	0
	D	Solving a Trig Equation	39	1.59	1	0	8	0
		Identify Graphs	39	1.85	2	1	4	0
		Reasoning from Graphic Data	39	7.49	8	9	10	0
	F	Solving a Trig Equation	32	1.09	0	0	10	0
		Identify Graphs	32	2.16	2	2	4	0
		Reasoning from Graphic Data	32	6.19	7	0	12	0
W	Solving a Trig Equation	2	0	0	0	0	0	
	Identify Graphs	2	0	0	0	0	0	
	Reasoning from Graphic Data	2	0	0	0	0	0	

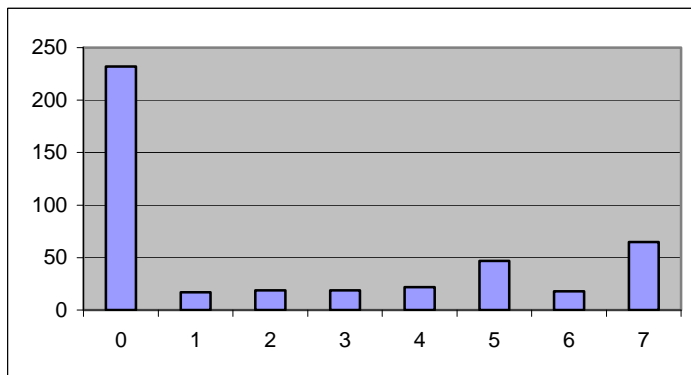
Question #13

Use algebra to solve the given equation

$3x^2 - x - 5 = 0$. Round solutions to three decimal places.

Performance by all students

Score	N	%
0	232	52.8%
1	17	3.9%
2	19	4.3%
3	19	4.3%
4	22	5.0%
5	47	10.7%
6	18	4.1%
7	65	14.8%



This question calls in to question our teaching (or perhaps the way we teach) the quadratic formula in MA091. We had seen poor performance on this question on the Spring 2007 final exam and decided to investigate further. A majority of the students received no credit for this question, with only 15% receiving full credit.

The average of all students was a 2.27 with a standard deviation of 2.77 out of a possible 7 points.

Performance based on grade in course

Here we see A students far outperforming the other groups with less than 10% of C students getting full credit for this question.

Grade	Q13	N	% receiving full credit	% receiving no credit
A	5.00	54	50.0%	20.3%
B	2.90	93	19.4%	41.9%
C	2.05	147	9.5%	53.7%
U	1.04	141	3.5%	71.6%

Performance by Modality

Due to poor performance on this question by ICL students in the Spring of 2007, changes were made that allowed us to include the quadratic formula on the last exam in the ICL course rather than leaving it for the final exam only. Scores in ICL were higher than teacher directed for Fall 2007, 2.45 for ICL and 2.19 for teacher directed. In addition, 15% of ICL students received full credit as opposed to 7% for Spring 2007.

Question #11

Use the quadratic formula to solve the equation.

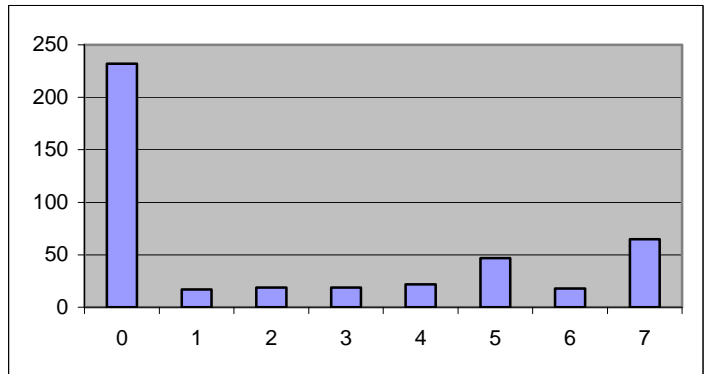
$$3x^2 - x - 5 = 0. \text{ Round solutions to three decimal places.}$$

This same question appeared on the Fall 2007 final exam with the directions reading *Use algebra to solve the given equation.*

Due to the poor performance on the question in Fall 2007, the course chairs changed the directions so that we could attempt to identify how much of the poor performance on the question was due to the vagueness of the directions and how much of it was due to the students not being able to use the quadratic formula.

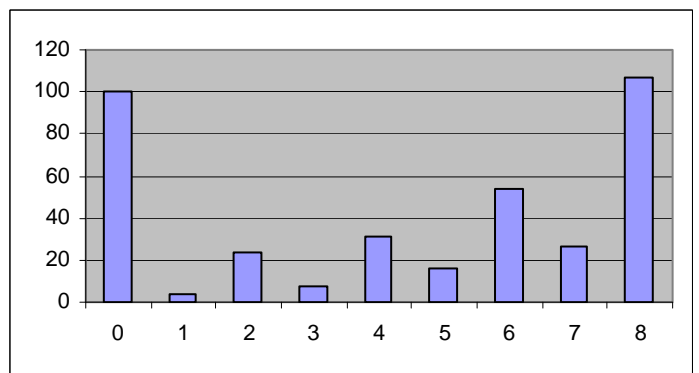
Performance by all students in Fall 2007

Score	N	%
0	232	52.8%
1	17	3.9%
2	19	4.3%
3	19	4.3%
4	22	5.0%
5	47	10.7%
6	18	4.1%
7	65	14.8%



Performance by all students in Spring 2008

Score	N	%
0	100	27.0%
1	4	1.1%
2	24	6.5%
3	8	2.2%
4	31	8.4%
5	16	4.3%
6	54	14.6%
7	26	7.0%
8	107	28.9%



As expected, students did better when told to use the quadratic formula rather than being left to figure it out for themselves. The average of all students in Fall 2007 was a 2.27 out of 7 (32%) with a standard deviation of 2.77. The average of all students in Spring 2008 was a 4.44 out of 8 (56%) with a standard deviation of 3.23.

Performance based on grade in course

Fall 2007

Grade	Average score* on question	N	% receiving full credit	% receiving no credit
A	71.4%	54	50.0%	20.3%
B	41.4%	93	19.4%	41.9%
C	29.3%	147	9.5%	53.7%
U	14.9%	141	3.5%	71.6%

Spring 2008

Grade	Average score* on question	N	% receiving full credit	% receiving no credit
A	89.9%	73	78.1%	4.1%
B	73.1%	91	36.3%	8.8%
C	48.9%	120	14.2%	27.5%
U	16.9%	86	3.5%	65.1%

*In fall 2007 the percentage is value out of 7 points , in spring 2008 the percentage is value out of 8 points.

A dramatic improvement was seen by the A, B, and C students but there was little difference for U students.

Scores are reported as “Average score on question” due to the fact that the question was worth a different number of points in the spring.

Performance by Modality

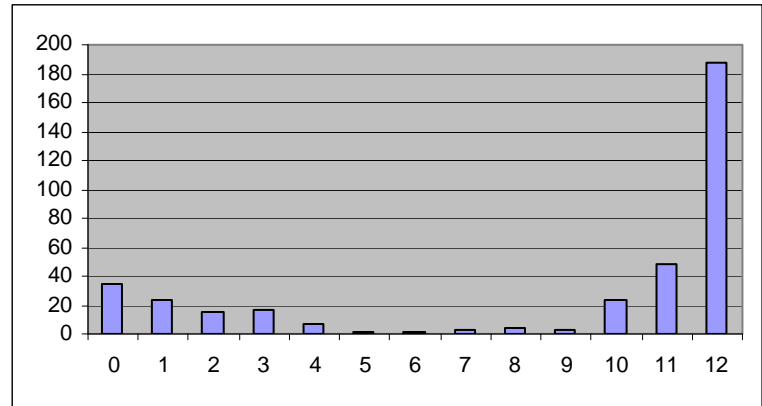
ICL students did slightly worse on this question with an average score of 4.40 as opposed to a 4.46 for teacher directed classes. There was significant improvement in both groups from the Fall 2007 exam.

Question #25

A 16 ft ladder is leaning against a building. The bottom is 7 ft from the building. How high is the top of the ladder from the ground? Round your answer to the nearest tenth.

Performance by all students

Score	N	%
0	34	9.2%
1	24	6.5%
2	15	4.1%
3	17	4.6%
4	7	1.9%
5	2	0.5%
6	2	0.5%
7	3	0.8%
8	4	1.1%
9	3	0.8%
10	23	6.2%
11	48	13.0%
12	188	50.8%



Over half of all students received full credit and, 70% received a score of 10 or more.

The average of all students was a 8.79 with a standard deviation of 4.59 out of a possible 12 points.

Performance based on grade in course

Grade	Score	N	% receiving full credit	% receiving no credit
A	11.30	73	83.6%	1.4%
B	10.35	91	61.5%	2.2%
C	7.73	120	37.5%	13.3%
U	6.45	86	30.2%	17.4%

On the fall 2007 exam, data was collected about a word problem on systems of linear equations. On that question, nearly half of all U students received no credit and very few received full credit. Anecdotally, it was believed that students performed better on this Pythagorean formula question and the data supports this belief.

Performance by Modality

ICL students and teacher directed students performed similarly on this question. Teacher directed students averaged a 8.78 and ICL students averaged a 8.81.

Performance by Section

CRN	Q6	Q6 Rank	Q11	Q11 Rank	Q19	Q19 Rank	Q23	Q23 Rank	Q25	Q25 Rank	ICL	Average Rank
A	4.57	9	5.14	6	5.14	13	5.29	15	9.07	11	No	10.8
B	4.35	11	2.47	19	5.88	9	5.00	18	5.41	20	No	15.4
C	5.22	3	4.56	10	6.78	3	7.44	7	9.11	10	Yes	6.6
D	5.47	2	4.76	9	6.35	5	4.94	19	7.06	15	No	10
E	3.86	15	3.64	16	6.18	6	6.64	12	6.77	17	Yes	13.2
F	4.30	12	4.35	12	5.10	14	7.80	5	6.90	16	Yes	11.8
G	3.91	14	3.74	15	6.09	7	6.65	11	9.65	8	No	11
H	3.33	20	3.86	14	5.71	10	7.19	9	8.62	12	No	13
I	4.69	7	4.19	13	4.50	19	7.25	8	10.00	6	Yes	10.6
J	5.20	4	5.30	5	4.60	18	7.90	4	11.70	2	Yes	6.6
K	3.37	19	1.32	20	5.16	11	6.21	13	6.11	19	No	16.4
L	4.94	6	3.53	17	6.59	4	6.18	14	10.88	5	No	9.2
M	4.40	10	4.55	11	5.15	12	5.05	17	6.50	18	No	13.6
N	5.00	5	5.14	6	6.00	8	8.57	2	10.93	4	Yes	5
O	3.68	17	3.37	18	3.68	20	7.16	10	8.42	13	Yes	15.6
P	4.67	8	5.60	4	7.07	2	9.20	1	9.33	9	Yes	4.8
Q	4.00	13	6.83	1	7.33	1	8.29	3	11.71	1	No	3.8
R	6.18	1	5.64	3	5.00	15	7.55	6	7.77	14	No	7.8
S	3.48	18	4.96	8	4.91	16	4.35	20	11.04	3	No	13
T	3.84	16	5.95	2	4.84	17	5.26	16	9.95	7	No	11.6