

Version B

JIT 1.1 – 1.5, 1.8, 3.1 – 3.3, 4.1 – 4.6, 7.1 – 7.5, 8.1, 11.1

Student's Printed Name: ANSWER KEY AND
GRADING GUIDELINES

CUID: _____

Instructor: _____

Section # : _____

You are **not** permitted to use a calculator on any portion of this test. You are **not** allowed to use any textbook, notes, cell phone, laptop, PDA, or any technology on either portion of this test. All devices must be turned off while you are in the testing room.

During this test, any communication with any person (other than the instructor or his designated proctor) in any form, including written, signed, verbal, or digital, is understood to be a violation of academic integrity.

No part of this test may be removed from the testing room.

Read each question very carefully. In order to receive full credit for the free response portion of the test, you must:

1. Show legible and logical (relevant) justification which supports your final answer.
2. Use complete and correct mathematical notation.
3. Include proper units, if necessary.
4. Give exact numerical values whenever possible.

You have **90 minutes** to complete the entire test.

On my honor, I have neither given nor received inappropriate or unauthorized information at any time before or during this test.

Student's Signature: _____

Do not write below this line.

Free Response Problem	Possible Points	Points Earned	Free Response Problem	Possible Points	Points Earned
1	6		4	7	
2a	4		5	6	
2b	4		6	1	
2c	4		Free Response	40	
3	8		Multiple Choice	60	
			Test Total	100	

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Multiple Choice. There are 22 multiple choice questions. Each question is worth 2 – 3 points and has one correct answer. The multiple choice problems will count 60% of the total grade. Use a number 2 pencil and bubble in the letter of your response on the scantron sheet for problems 1 – 22. For your own record, also circle your choice on your test since the scantron will not be returned to you. Only the responses recorded on your scantron sheet will be graded. You are NOT permitted to use a calculator on any portion of this test.

#1. Convert 116° to radians.
(3 pts.)

a) $\frac{29}{45}\pi$ radians

b) $\frac{29}{45}$ radians

c) $\frac{45}{29\pi}$ radians

d) $\frac{1}{\pi}$ radians

#2. Solve for x : $3xy + 2z = xz + zy$
(3 pts.)

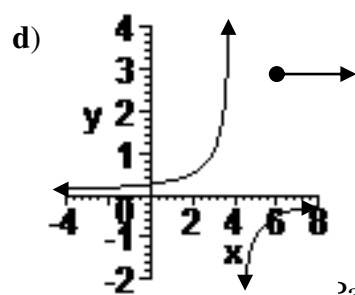
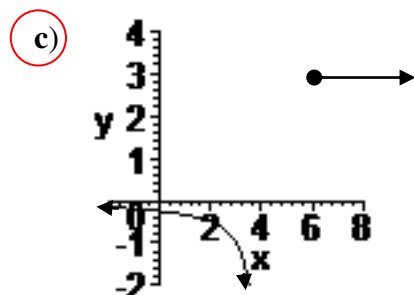
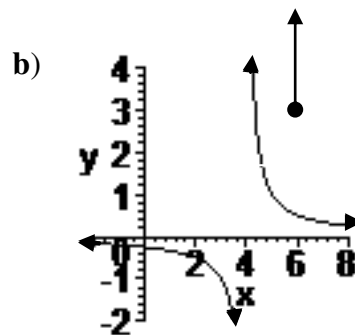
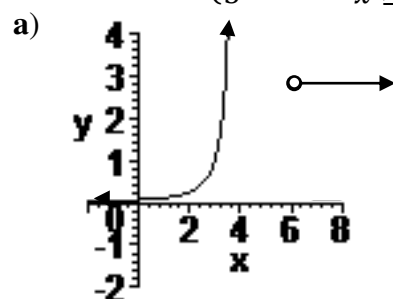
a) $x = \frac{y-2}{3y-1}$

b) $x = -\frac{1}{3}$

c) $x = \frac{xz+zy-2z}{3y}$

d) $x = \frac{zy-2z}{3y-z}$

#3. (3 pts.) Graph $f(x) = \begin{cases} \frac{1}{x-4} & x < 4 \\ 3 & x \geq 6 \end{cases}$



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#4. (3 pts.) Simplify $\left(\frac{3x^3y^{-3}}{x^{-5}y^4}\right)^{-2}$

a) $\frac{3x^{16}}{y^{14}}$

b) $\frac{y^{14}}{3x^{16}}$

c) $\frac{y^{14}}{9x^{16}}$

d) $\frac{-9y^{14}}{x^{16}}$

#5. (3 pts.) Determine all solutions to $2 \sin^2 x = -\sqrt{3} \sin x$ on $[0, 2\pi)$

a) $0, \pi, \frac{4\pi}{3}, \frac{5\pi}{3}$

b) $0, \frac{\pi}{6}, \frac{5\pi}{6}, \pi$

c) $\frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{2}$

d) $\frac{4\pi}{3}, \frac{5\pi}{3}$

#6. (3 pts.) Given $f(x) = \sqrt{x-1}$, $g(x) = 3x$, $h(x) = \csc(x)$, determine $(h \circ g \circ f)(x)$.

a) $\sqrt{3 \csc x - 1}$

b) $\csc(3\sqrt{x-1})$

c) $3\sqrt{\csc x - 1}$

d) $\csc(3\sqrt{x-1})$

#7. (2 pts.) Use the quadratic formula to solve for x : $qx^2 - yx = -5$.

a) $x = \frac{-y \pm \sqrt{y^2 - 20q}}{2}$

b) $x = \frac{y \pm \sqrt{-y^2 - 20q}}{2}$

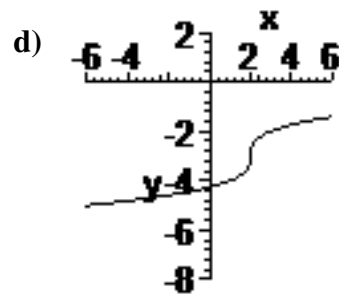
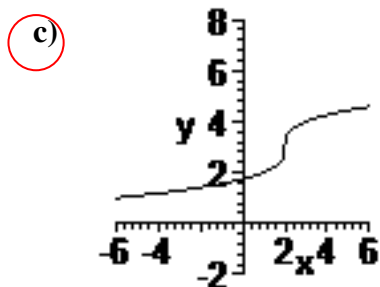
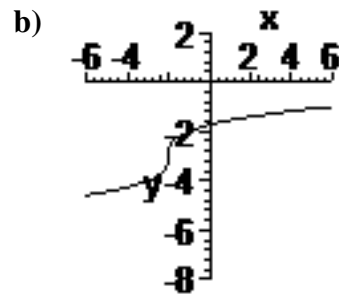
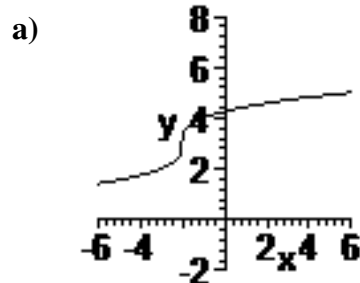
c) $x = \frac{-y \pm \sqrt{y^2 + 20q}}{2q}$

d) $x = \frac{y \pm \sqrt{y^2 - 20q}}{2q}$

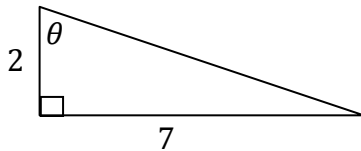
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#8. Graph $y = \sqrt[3]{x-2} + 3$
(3 pts.)



#9. Determine $\sin \theta$ and $\cos \theta$ for the angle shown.
(3 pts.)



a) $\sin \theta = \frac{2}{\sqrt{53}}, \cos \theta = \frac{7}{\sqrt{53}}$

b) $\sin \theta = \frac{7}{\sqrt{53}}, \cos \theta = \frac{2}{\sqrt{53}}$

c) $\sin \theta = \frac{7}{\sqrt{45}}, \cos \theta = \frac{2}{\sqrt{45}}$

d) $\sin \theta = \frac{2}{7}, \cos \theta = \frac{7}{9}$

#10. Determine the equation of a line parallel to $3x - 2y = 6$ and passing through the point $(5, -8)$.
(3 pts.)

a) $y + 8 = \frac{3}{2}(x - 5)$

b) $y + 8 = -2x + 6$

c) $y + 8 = \frac{2}{3}(x - 5)$

d) $y - 8 = -\frac{3}{2}(x - 5)$

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#11. Evaluate $\cos \frac{7\pi}{3}$.
(3 pts.)

- a) $\frac{1}{2}$ b) $\frac{\sqrt{3}}{2}$ c) $-\frac{1}{2}$ d) $-\frac{\sqrt{3}}{2}$

#12. Which statement correctly describes $f(x) = x^7$?
(3 pts.)

- a) The function is even and the graph is symmetric with respect to the origin.
b) The function is odd and the graph is symmetric with respect to the y –axis.
c) The function is even and the graph is symmetric with respect to the y –axis
d) The function is odd and the graph is symmetric with respect to the origin.

#13. Simplify $\frac{x}{y} - \frac{y}{x}$.
(3 pts.)

- a) $\frac{x^2-y^2}{xy}$ b) $\frac{x^2-y^2}{x^2y^2}$
c) $\frac{x-y}{xy}$ d) $x - y$

#14. Simplify $\left(\frac{3}{2} \div \frac{\pi}{6}\right) \cdot \frac{1}{9}$.
(2 pts.)

- a) $\frac{1}{\pi}$ b) $\frac{\pi}{36}$ c) $\frac{81}{\pi}$ d) π

#15. Simplify $\frac{\sin^3(x) + \sin(x) \cos^2(x)}{\tan(x)}$.
(3 pts.)

- a) $-\sec x$ b) $\cos x$ c) $\frac{1}{\tan x}$ d) $\sin x$

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#21. (2 pts.) Simplify $\frac{5(5-6)^2 - 5 \cdot 9 + 8 \cdot 10}{4^1 + 17^0}$

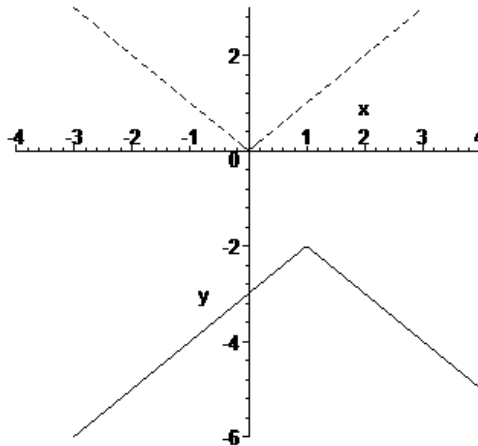
a) 10

b) 6

c) $\frac{15}{2}$

d) 8

#22. (3 pts.) The graph below shows $y = |x|$ as a dashed line. Write an equation for the graph shown as a **solid line**.



a) $y = -|x + 1| + 2$

b) $y = -|x + 1| - 2$

c) $y = -|x - 1| - 2$

d) $y = |-x + 1| - 2$

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Free Response. The Free Response questions will count 40% of the total grade. Read each question carefully. In order to receive full credit you must show legible and logical (relevant) justification which supports your final answer. Give answers as exact answers. You are NOT permitted to use a calculator on any portion of this test.

1. [6 points] Determine all solutions to the equation $2x^2 = x + 6$.

$$2x^2 - x - 6 = 0$$

$$(2x + 3)(x - 2) = 0$$

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

OR

$$2x^2 - x - 6 = 0$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(2)(-6)}}{2(2)}$$

$$x = \frac{1 \pm \sqrt{1 + 48}}{4} = \frac{1 \pm 7}{4}$$

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

<u>Work on Problem</u>	<u>Points Awarded</u>
Equivalent equation = 0	2
Correct factorization OR Correct setup for quadratic formula	2
Valid solution (follow from previous step)	1 each (2 total)
Notes: Deduct ½ point for improper/poor notation, e.g. writing an expression instead of equation Deduct ½ point for ruling out a valid solution Deduct 1 point for “almost correct” factorization (e.g., off by plus/minus)	

2. Line L is determined by the points $(-3, -\frac{15}{4})$ and $(8, -1)$.

- a. [4 points] Determine the slope of line L .

$$m = \frac{-\frac{15}{4} - (-1)}{-3 - 8} = \frac{-\frac{11}{4}}{-11} = -\frac{11}{4} \cdot \frac{1}{-11} = \frac{1}{4}$$

$$m = \frac{1}{4}$$

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OR

$$m = \frac{-1 - \left(-\frac{15}{4}\right)}{8 - (-3)} = \frac{\frac{11}{4}}{11} = \frac{11}{4} \cdot \frac{1}{11} = \frac{1}{4}$$

$$m = \frac{1}{4}$$

Work on Problem	Points Awarded
Correct values paired numerator/denominator	1
Correct signs numerator/denominator	1
Numerator simplified correctly	1
Division handled correctly	1
Notes:	

b. [4 points] Write the *slope-intercept* equation for line L .

$$y - \left(-\frac{15}{4}\right) = \frac{1}{4}(x - (-3))$$

$$y + \frac{15}{4} = \frac{1}{4}x + \frac{3}{4}$$

$$y = \frac{1}{4}x + \frac{3}{4} - \frac{15}{4} = \frac{1}{4}x - \frac{12}{4}$$

$$y = \frac{1}{4}x - 3$$

OR

$$y - (-1) = \frac{1}{4}(x - 8)$$

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

$$y = \frac{1}{4}x - 3$$

OR

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

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

$$-3 = b$$

$$y = \frac{1}{4}x - 3$$

OR

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

$$-\frac{15}{4} = \frac{1}{4}(-3) + b$$

$$-\frac{15}{4} + \frac{3}{4} = b$$

$$b = -3$$

$$y = \frac{1}{4}x - 3$$

<u>Work on Problem</u>	<u>Points Awarded</u>
Correct use of slope from (a) in either point-slope or slope-intercept form	1
Correct use of one given point on the line in either point-slope or slope-intercept form	1
Value of b determined correctly from setup (follow work)	1
Final answer in slope-intercept form using slope from (a) and value of b determined from work	1
Notes:	

- c. [4 points] Write a *point-slope* equation for a line perpendicular to L and passing through the point $(-2,3)$.

$$y - 3 = -4(x + 2)$$

<u>Work on Problem</u>	<u>Points Awarded</u>
Slope used is the negative reciprocal of the slope determined in part (a)	2
Line given passes through the point $(-2,3)$ (whether equation is in point-slope form, slope-intercept form, or a mixed form)	1
Final answer is in point-slope form	1
Notes:	

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3. [8 points] For the equation $y = -\frac{5}{2} \cos\left(\frac{1}{2}x\right) - 1$
- Determine the amplitude of the graph.

$$\left| -\frac{5}{2} \right| = \frac{5}{2}$$

- Determine the period of the graph.

$$\left| \frac{2\pi}{1/2} \right| = 4\pi$$

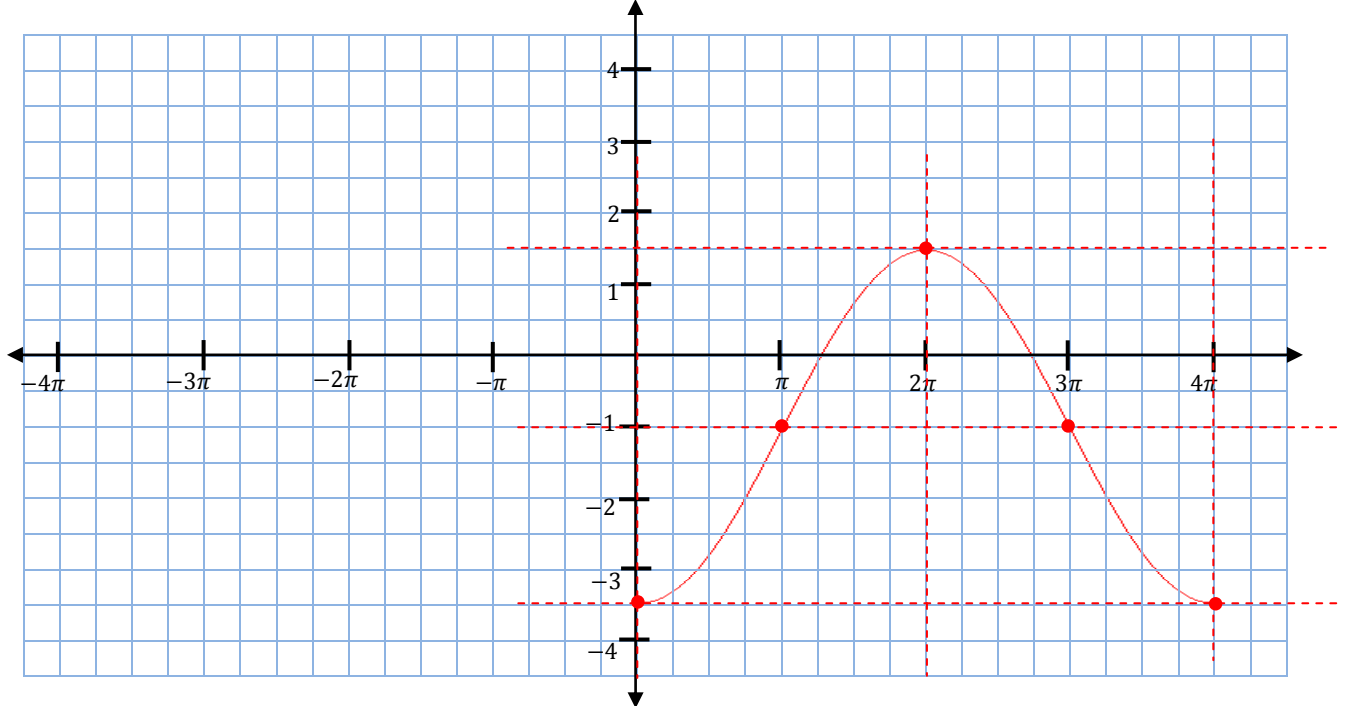
- Determine the phase shift (if any) of the graph.

No phase shift.

- Determine the range of the graph. Express your answer in interval notation.

$$\left[-\frac{7}{2}, \frac{3}{2} \right]$$

- Graph *exactly one period* of the graph on the axes below.



<u>Work on Problem</u>	<u>Points Awarded</u>
Correct amplitude (half credit for correct magnitude, wrong sign)	1
Correct period	1
Correct (no) phase shift	1
Correct endpoints for range	1
Correct interval notation for range	1/2
Graph shows correct shape for exactly one period of cosine function	1/2
Graph shown with correct phase shift	1/2
Graph shown with reflection over horizontal center	1/2
Graph demonstrates amplitude determined in (a)	1/2
Graph demonstrates period determined in (b)	1/2
Graph demonstrates correct vertical shift OR range matching part (d)	1/2
Notes: Do NOT have to show boundaries and centers of one box as long as graph is clear. Do NOT have to specifically mark five key points as long as graph is clear.	

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4. [7 points] Solve $\sqrt{3x-2} = x-2$. Express your answer in set notation.

$$(\sqrt{3x-2})^2 = (x-2)^2$$

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

$$x^2-7x+6 = 0$$

$$(x-6)(x-1) = 0$$

OR

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(1)(6)}}{2(1)} = \frac{7 \pm \sqrt{25}}{2} = \frac{7 \pm 5}{2}$$

$$x = 6, x = 1$$

Check $x = 6$: $\sqrt{3(6)-2} = \sqrt{16} = 4$ while $6-2 = 4$; $x = 6$ checks

Check $x = 1$: $\sqrt{3(1)-2} = \sqrt{1} = 1$ while $1-2 = -1$; $x = -1$ does NOT check

{6}

Work on Problem	Points Awarded
Squaring both sides (does not have to be explicitly shown)	1
Squaring left side correctly	1
Squaring right side correctly	1
Writing equivalent equation = 0	1
Factoring OR using quadratic formula to arrive at two candidate solutions	1
Checking solutions (must INDICATE the check step in some way, although the full calculation does not need to be shown)	1
Solution set written using set notation	1
Notes: If right side is squared incorrectly, deduct 1 point and follow work If arithmetic error is made in writing as equation = 0, deduct 1 point and follow work	

5. [6 points] Given that $\sin \theta = \frac{4}{7}$ and that $\frac{\pi}{2} < \theta < \pi$,

- a. Evaluate $\csc \theta$.

$$\csc \theta = \frac{1}{\sin \theta} = \frac{7}{4}$$

OR

$$\sin \theta = \frac{y}{r}$$

$$y = 4, r = 7$$

$$\csc \theta = \frac{r}{y} = \frac{7}{4}$$

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b. Evaluate $\tan \theta$.

$$\sin \theta = \frac{y}{r}$$

$$y = 4, r = 7$$

$$x^2 = r^2 - y^2 = 7^2 - 4^2 = 49 - 16 = 33$$

$$x = \pm\sqrt{33}$$

In Quadrant II, $x < 0$, so $x = -\sqrt{33}$.

$$\tan \theta = \frac{y}{x}$$

$$\tan \theta = -\frac{4}{\sqrt{33}}$$

<u>Work on Problem</u>	<u>Points Awarded</u>
Recognition that $\sin \theta = \frac{y}{r}$ (explicitly or implicitly)	1
Using $x^2 + y^2 = r^2$ relationship to set up solving for y (explicitly or implicitly)	1
Determining that $x = \pm\sqrt{33}$	1
Using quadrants to conclude that $x = -\sqrt{33}$	1
Correct ratio for $\sec \theta$	1
Correct ratio for $\tan \theta$ (using values calculated)	1
Notes: Do NOT have to state that $x = \pm\sqrt{33}$; going directly to $x = -\sqrt{33} \rightarrow$ both points awarded	

6. (1 pt) Check to make sure your Scantron form meets the following criteria. If any of the items are NOT satisfied when your Scantron is handed in and/or when your Scantron is processed one point will be subtracted from your test total.

My scantron:

- is bubbled with firm marks so that the form can be machine read;
- is not damaged and has no stray marks (the form can be machine read)
- ... (rest deleted to save printing)