## Module 4 - Answers 4.1

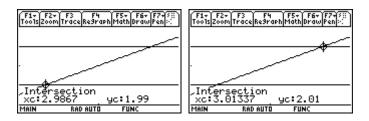
Answer 1 4.1.1 The smaller of the two choices, 0.13, will ensure that the output is within 0.1 of 2. If a point on the graph of the function has an *x*-coordinate that is within 0.13 of 3, then it will lie between the two horizontal lines and its *y*-coordinate will be within 0.1 of 2. This means that in order to achieve a *y*-tolerance of 0.1 you need to have an *x*-tolerance of 0.13 (or less.)

Answer 2 4.1.2

• Graph

$$y1 = \sqrt{3 \times -5}$$
  
y2 = 2 - 0.01 = 1.99  
y3 = 2 + 0.01 = 2.01

- Set the viewing window to [2.98, 3.02] x [1.98, 2.02]
- Find the intersection points by using the Intersect command



Use the intersection points to find the tolerance for *x* that produces a *y*-tolerance of 0.01.

F1+ F2+ F3+ F4+ F5 F6+ ToolsA19ebraCa1cOtherPr9mlOClean Up			
• 3 - 2.9	9867		.0133
• 3.0133	37 - 3		01337
3.01337	'-3		
MAIN	RAD AUTO	FUNC	2/30

Choose the smaller of the two tolerances. The *y*-tolerance is 0.01 when the *x*-tolerance is 0.0133.

## <u>4.2</u>

Answer 1 4.2.1 Find a positive number  $\delta$  so that 1.99 <  $\sqrt{3 \times -5}$  < 2.01 whenever 3 –  $\delta$  < x < 3+ $\delta$ 

Answer 2 4.2.2 2.9867 < *x* < 3.01337

Answer 3 4.2.3

Solve 3 –  $\delta \approx 2.9867$  and 3 +  $\delta \approx 3.01337$  for  $\delta$  to obtain  $\delta \approx 0.0133$  and  $\delta \approx 0.01337$ .

The correct tolerance is the minimum of the two values,  $\delta \approx 0.0133$ .

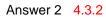
Answer 4 4.2.4 For each positive  $\mathcal{E}$  there is a positive  $\delta$  such that  $5 - \mathcal{E} < \sqrt{3 \times -5} < 5 + \mathcal{E}$  whenever  $10 - \delta < x < 10 + \delta$ 

 $\lim_{x \to 10} \sqrt{3x - 5} = 5$  means that  $\sqrt{3x - 5} \to 5$  as  $x \to 10$ .

**4.3** Answer 1 4.3.1

F1+ F2 Tools A19e	+ F3+ F4+ braCa1cOtherP	FS Fé r9ml0(Clea	n Up
■ lim√ ×→3	3·×−5		2
• lim 0→0	$\frac{\sin(\theta)}{\theta}$		1
limit(	$\sin(\theta)/\theta, \theta$	9,0)	2.120
MAIN	RAD AUTO	FUNC	2/30

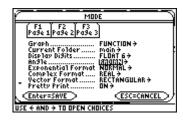




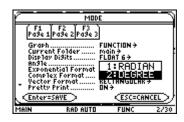
• Display the mode settings dialog box by pressing MODE

The fourth item in the menu is the Angle mode.

• Select Angle's setting by pressing Sthree times



- Open the Angle submenu by pressing
- Highlight "Degree" by pressing 🕤



- Select "Degree" by pressing ENTER
- Save the changes and exit the Mode screen by press ENTER

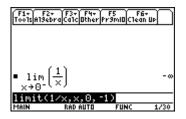
The mode settings under the Edit Line should say DEG to indicate the calculator is currently in Degree mode.

The limit function should still be on the Edit Line.

• Execute it again by pressing ENTER

(F1+ F2+ F3+ F4+ F5 ToolsAl3ebra(CalcOtherPr3mIOClean UP) ×→3			
= lim 0→0	$\frac{\sin(\theta)}{\theta}$		1
	$\frac{\sin(\theta)}{\theta}$		$\frac{\pi}{180}$
	sin(θ)/θ, DEGAUTO	θ,0) FUNC	3/30

Answer 3 4.3.3  $\times 10^{-1}$  represents the value that  $f(x) = \frac{1}{x}$  approaches as x approaches 0 from the left.



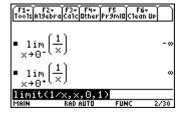
 $\lim_{x\to 0^{-}}\frac{1}{x}$ = - 00

which is interpreted as

 $\frac{1}{x}$  $\rightarrow -\infty$  when  $x \rightarrow 0$  from the left.

Answer 4 4.3.4

 $\lim_{x\to 0^+} \frac{1}{x}$  represents the value that  $f(x) = \frac{1}{x}$  approaches as x approaches 0 from the right.



lim  $x \rightarrow 0^+ \times = 00$ 

which is interpreted as

 $\frac{1}{x} \rightarrow \infty$  when  $x \rightarrow 0$  from the right.

## Self Test

Answer 1		
F1+ F2+ F3 F4 F5+ F6+ F7+5: Too1sZoomTraceRe9raphMathDrawPen::	F1+ F2+ F3 F4 F5+ F6+ F7+ <sup>5</sup> : Tools Zoom Trace Regraph MathDraw Pen ::	F1+ F2+ F3+ F4+ F5 F6+ ToolsAl9ebraCalcOtherPr9mI0Clean UP
		roominises dealelatier in some erean av
	¥	
. /	. /	
		1948683 .051317
Intersection	Intersection	1.04881 - 1 .04881
xc: 948683 yc: 3.9	xc:1.04881 yc:4.1	1.04881-1
MAIN RAD AUTO FUNC	MAIN RAD AUTO FUNC	MAIN RAD AUTO FUNC 2/30

x should be within approximately 0.04881 of 1

Answer 2

Find a positive number  $\delta$  so that 3.9 <  $x^2$  + 3 < 4.1 whenever 1 –  $\delta$  < x < 1 +  $\delta$ 

F1+ F2+ F3+ F4+ F5 ToolsAl3ebraCalcOtherPr3mlOClean Up
■ solve(3.9 = x <sup>2</sup> + 3, x) x = .948683 or x = <sup>-</sup> .948683
■ solve(x <sup>2</sup> + 3 = 4.1, x) x = 1.04881 or x = -1.04881
solve(x^2+3=4.1,x) MAIN RAD AUTO FUNC

Because x is near 1, the positive solutions are what we need. Therefore,

 $1 - \delta = 0.948683$  and  $1 + \delta = 1.04881$ .

Solve for  $\delta$ 

F1+ F2+ Tools#19ebr	aCa1cOther	FS FI Pr9ml0Clea	ā∓ n UP
194	8683	.0	51317
1.0488	1 - 1		04881
1.04881	-1		
MAIN	RAD AUTO	FUNC	2/30

Taking the minimum of the two values, *x* should be within approximately 0.04881 of 1.

Answer 3

a. 4

- b. 3 c. - 00
- d. 00

Answer 4 Answers may vary but should include a graph of  $y = \frac{x+1}{x+2}$  that shows the vertical asymptotic behavior of the function at x = -2. The Trace cursor should have an *x*-coordinate slightly to the right of x = -2 and show a large negative *y*-coordinate.

F1+ F2+ F) ToolsZoomTro	3 F4 IceRe9ra	>hMathDr	6+ F7+80 awPen
	1		1
	ή	-	
xc:-1.99 Main	9 Rad Auto	90: -9 FUNC	99.

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