

Math Sheet

Name _____ Score _____ Teacher _____ Date _____

Newton's Method

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

1. degree 3

$$f(x) = -16 + 14 \cdot x - 6 \cdot x^2 + x^3$$

Start $x_0 = 4.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

2. degree 5

$$f(x) = -1698 + 28 \cdot x + 40 \cdot x^2 + 32 \cdot x^3 + 13 \cdot x^4 + 2 \cdot x^5$$

Start $x_0 = 3.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

3. trigonometric

$$f(x) = -8 \cdot \sin(4 \cdot x + 1) + 5$$

Start $x_0 = -0.100000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

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Newton's Method

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

4. degree 4

$$f(x) = 194 + 304 \cdot x + 136 \cdot x^2 + 27 \cdot x^3 + 2 \cdot x^4$$

Start $x_0 = -1.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

5. trigonometric

$$f(x) = 6 \cdot \sin(3 \cdot x + 4) - 2$$

Start $x_0 = -1.200000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

6. degree 4

$$f(x) = -365 + 79 \cdot x + 51 \cdot x^2 + 16 \cdot x^3 + 2 \cdot x^4$$

Start $x_0 = 2.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

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Newton's Method

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

7. degree 3

$$f(x) = -216 + 78 \cdot x - 26 \cdot x^2 + 3 \cdot x^3$$

Start $x_0 = 7.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

8. degree 5

$$f(x) = -88 + 25 \cdot x + 33 \cdot x^2 + 26 \cdot x^3 + 11 \cdot x^4 + 2 \cdot x^5$$

Start $x_0 = 1.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

9. degree 5

$$f(x) = -3525 + 373 \cdot x + 327 \cdot x^2 + 146 \cdot x^3 + 33 \cdot x^4 + 3 \cdot x^5$$

Start $x_0 = 2.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

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Newton's Method

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

10. degree 3

$$f(x) = -80 + 10 \cdot x + 5 \cdot x^2 + x^3$$

Start $x_0 = 3.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

11. degree 4

$$f(x) = -270 - 7 \cdot x + 13 \cdot x^2 - 10 \cdot x^3 + 3 \cdot x^4$$

Start $x_0 = 4.000000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

12. trigonometric

$$f(x) = -5 \cdot \sin(5 \cdot x - 2) + 3$$

Start $x_0 = 0.600000$. Complete 2 Newton iterations using full precision.

Derivative $f'(x)$: _____

i	x_i	$f(x_i)$	$f'(x_i)$	$x_{(i+1)}$
0	_____	_____	_____	_____
1	_____	_____	_____	_____

Nth iterate: _____

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Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

1. degree 3

$$f(x) = -16 + 14x - 6x^2 + x^3$$

$$f'(x) = 14 - 12x + 3x^2$$

$$x_{\text{next}} = x - \frac{-16 + 14x - 6x^2 + x^3}{14 - 12x + 3x^2}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	4.000000	8.000000	14.000000	0.571429	3.428571
1	3.428571	1.772595	8.122449	0.218234	3.210337

After 2 iterations, x₂ approximately equals 3.210337. The residual |f(x₂)| is approximately 0.193718; this reports the computed approximation, not an exact zero.

2. degree 5

$$f(x) = -1698 + 28x + 40x^2 + 32x^3 + 13x^4 + 2x^5$$

$$f'(x) = 28 + 80x + 96x^2 + 52x^3 + 10x^4$$

$$x_{\text{next}} = x - \frac{-1698 + 28x + 40x^2 + 32x^3 + 13x^4 + 2x^5}{28 + 80x + 96x^2 + 52x^3 + 10x^4}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	3.000000	1149.000000	3346.000000	0.343395	2.656605
1	2.656605	170.821573	2391.097503	0.071441	2.585164

After 2 iterations, x₂ approximately equals 2.585164. The residual |f(x₂)| is approximately 6.116699; this reports the computed approximation, not an exact zero.

Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

3. trigonometric

$$f(x) = -8 \cdot \sin(4 \cdot x + 1) + 5$$

$$f'(x) = -32 \cdot \cos(4 \cdot x + 1)$$

$$x_{\text{next}} = x - \frac{-8 \cdot \sin(4 \cdot x + 1) + 5}{-32 \cdot \cos(4 \cdot x + 1)}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	-0.100000	0.482860	-26.410740	-0.018283	-0.081717
1	-0.081717	0.012504	-25.019955	-0.000500	-0.081218

After 2 iterations, x₂ approximately equals -0.081218. The residual |f(x₂)| is approximately 9.973819e-6; this reports the computed approximation, not an exact zero.

4. degree 4

$$f(x) = 194 + 304 \cdot x + 136 \cdot x^2 + 27 \cdot x^3 + 2 \cdot x^4$$

$$f'(x) = 304 + 272 \cdot x + 81 \cdot x^2 + 8 \cdot x^3$$

$$x_{\text{next}} = x - \frac{194 + 304 \cdot x + 136 \cdot x^2 + 27 \cdot x^3 + 2 \cdot x^4}{304 + 272 \cdot x + 81 \cdot x^2 + 8 \cdot x^3}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	-1.000000	1.000000	105.000000	0.009524	-1.009524
1	-1.009524	0.006061	103.728973	5.842824e-5	-1.009582

After 2 iterations, x₂ approximately equals -1.009582. The residual |f(x₂)| is approximately 2.268752e-7; this reports the computed approximation, not an exact zero.

Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

5. trigonometric

$$f(x) = 6 \cdot \sin(3 \cdot x + 4) - 2$$

$$f'(x) = 18 \cdot \cos(3 \cdot x + 4)$$

$$x_{\text{next}} = x - \frac{6 \cdot \sin(3 \cdot x + 4) - 2}{18 \cdot \cos(3 \cdot x + 4)}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	-1.200000	0.336510	16.579098	0.020297	-1.220297
1	-1.220297	-0.004122	16.974930	-0.000243	-1.220054

After 2 iterations, x₂ approximately equals -1.220054. The residual |f(x₂)| is approximately 5.300679e-7; this reports the computed approximation, not an exact zero.

6. degree 4

$$f(x) = -365 + 79 \cdot x + 51 \cdot x^2 + 16 \cdot x^3 + 2 \cdot x^4$$

$$f'(x) = 79 + 102 \cdot x + 48 \cdot x^2 + 8 \cdot x^3$$

$$x_{\text{next}} = x - \frac{-365 + 79 \cdot x + 51 \cdot x^2 + 16 \cdot x^3 + 2 \cdot x^4}{79 + 102 \cdot x + 48 \cdot x^2 + 8 \cdot x^3}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	2.000000	157.000000	539.000000	0.291280	1.708720
1	1.708720	15.768172	433.348071	0.036387	1.672333

After 2 iterations, x₂ approximately equals 1.672333. The residual |f(x₂)| is approximately 0.221080; this reports the computed approximation, not an exact zero.

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Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

7. degree 3

$$f(x) = -216 + 78 \cdot x - 26 \cdot x^2 + 3 \cdot x^3$$

$$f'(x) = 78 - 52 \cdot x + 9 \cdot x^2$$

$$x_{\text{next}} = x - \frac{-216 + 78 \cdot x - 26 \cdot x^2 + 3 \cdot x^3}{78 - 52 \cdot x + 9 \cdot x^2}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	7.000000	85.000000	155.000000	0.548387	6.451613
1	6.451613	10.632204	117.125911	0.090776	6.360837

After 2 iterations, x₂ approximately equals 6.360837. The residual |f(x₂)| is approximately 0.261976; this reports the computed approximation, not an exact zero.

8. degree 5

$$f(x) = -88 + 25 \cdot x + 33 \cdot x^2 + 26 \cdot x^3 + 11 \cdot x^4 + 2 \cdot x^5$$

$$f'(x) = 25 + 66 \cdot x + 78 \cdot x^2 + 44 \cdot x^3 + 10 \cdot x^4$$

$$x_{\text{next}} = x - \frac{-88 + 25 \cdot x + 33 \cdot x^2 + 26 \cdot x^3 + 11 \cdot x^4 + 2 \cdot x^5}{25 + 66 \cdot x + 78 \cdot x^2 + 44 \cdot x^3 + 10 \cdot x^4}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	1.000000	9.000000	223.000000	0.040359	0.959641
1	0.959641	0.315018	207.532943	0.001518	0.958123

After 2 iterations, x₂ approximately equals 0.958123. The residual |f(x₂)| is approximately 0.000429; this reports the computed approximation, not an exact zero.

Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

9. degree 5

$$f(x) = -3525 + 373 \cdot x + 327 \cdot x^2 + 146 \cdot x^3 + 33 \cdot x^4 + 3 \cdot x^5$$

$$f'(x) = 373 + 654 \cdot x + 438 \cdot x^2 + 132 \cdot x^3 + 15 \cdot x^4$$

$$x_{\text{next}} = x - \frac{-3525 + 373 \cdot x + 327 \cdot x^2 + 146 \cdot x^3 + 33 \cdot x^4 + 3 \cdot x^5}{373 + 654 \cdot x + 438 \cdot x^2 + 132 \cdot x^3 + 15 \cdot x^4}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	2.000000	321.000000	4729.000000	0.067879	1.932121
1	1.932121	10.133479	4432.828204	0.002286	1.929835

After 2 iterations, x₂ approximately equals 1.929835. The residual |f(x₂)| is approximately 0.011119; this reports the computed approximation, not an exact zero.

10. degree 3

$$f(x) = -80 + 10 \cdot x + 5 \cdot x^2 + x^3$$

$$f'(x) = 10 + 10 \cdot x + 3 \cdot x^2$$

$$x_{\text{next}} = x - \frac{-80 + 10 \cdot x + 5 \cdot x^2 + x^3}{10 + 10 \cdot x + 3 \cdot x^2}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	3.000000	22.000000	67.000000	0.328358	2.671642
1	2.671642	1.474064	58.129427	0.025358	2.646283

After 2 iterations, x₂ approximately equals 2.646283. The residual |f(x₂)| is approximately 0.008353; this reports the computed approximation, not an exact zero.

Newton's Method

Worked Answer Key

Use the stated starting value and Newton update to approximate one real zero. Trigonometric arguments are in radians; carry full precision between iterations.

11. degree 4

$$f(x) = -270 - 7 \cdot x + 13 \cdot x^2 - 10 \cdot x^3 + 3 \cdot x^4$$

$$f'(x) = -7 + 26 \cdot x - 30 \cdot x^2 + 12 \cdot x^3$$

$$x_{\text{next}} = x - \frac{-270 - 7 \cdot x + 13 \cdot x^2 - 10 \cdot x^3 + 3 \cdot x^4}{-7 + 26 \cdot x - 30 \cdot x^2 + 12 \cdot x^3}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	4.000000	38.000000	385.000000	0.098701	3.901299
1	3.901299	1.727038	350.369173	0.004929	3.896370

After 2 iterations, x₂ approximately equals 3.896370. The residual |f(x₂)| is approximately 0.004124; this reports the computed approximation, not an exact zero.

12. trigonometric

$$f(x) = -5 \cdot \sin(5 \cdot x - 2) + 3$$

$$f'(x) = -25 \cdot \cos(5 \cdot x - 2)$$

$$x_{\text{next}} = x - \frac{-5 \cdot \sin(5 \cdot x - 2) + 3}{-25 \cdot \cos(5 \cdot x - 2)}$$

i	x _i	f(x _i)	f'(x _i)	correction	x _(i+1)
0	0.600000	-1.207355	-13.507558	0.089384	0.510616
1	0.510616	0.373440	-21.272743	-0.017555	0.528171

After 2 iterations, x₂ approximately equals 0.528171. The residual |f(x₂)| is approximately 0.010591; this reports the computed approximation, not an exact zero.