Selected answers for all customized versions of Numerical Methods Book

Chapter 01.01 Introduction to Numerical Methods

Multiple Choice Test:

Answers

1. A
2. D
3. C
4. B
5. A
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_introduction.html

Problem Set

2. 0.06237758151 , 0.1463595047 , -0.04373708621
3. $\{a = 0.2904761905 , b = 19.69047619 , c = 1.085714286 \}$
4. 543.0420000
5. 1
6. 4.225167110
7. y(0)=5, dy/dx(0)=-4, y(2.5)=0.61563, dy/dx(2.5)=-0.53355

Chapter 01.02 Measuring Errors

Multiple Choice Test

Answers

1. B
2. C
3. C
4. B
5. A
6. D

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_measuringerror.html

Problem Set:

1 a) 0.8679 b) 0.8229 c) 0.8257 d) -0.04213 e) 0.04213 f) -5.102% g) 5.102% h) -0.04495 i) 0.04495 j) -5.462 k) 5.462 l) 0 m) 0.005%

2. 0.0221 or 2.221%

3. 2

4. Hessup

5. a) 2.4538 b) 1 c) 7 d) mainly truncation but round-off error is there also.

6. a) 3 or 4 or 5 or 6 b) 3 c) 5 d) 3 e) 4 f) 4 g) 3 h) 5 i) 6

Chapter 01.03 Sources of Error

Multiple Choice Test

Answers

1. D
2. B
3. D
4. A
5. C
6. D

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_sourcesoferror.html

Problem Set

1. 0.00006666666….

2. -0.00003333333…

3. -6.16

4. $-0.35427560 \ 10^{-5}$

5. 51.75

6. At T=-300F, alpha=3.255E-6 for part (a) and 3.0516E-6 for part (b)

Chapter 01.04 Binary Representation of Numbers

Multiple Choice Test

Answers

1. C
2. B
3. B
4. B
5. B
6. D

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_binaryrepresentation.html

Problem Set
1 a) 10011
1 b) 1001011
2 a) 55
2 b) 25
3 a) 0.011
3 b) 0.0001
3 b) 0.000100110011….
4 a) 0.765625
4 b) 0.4375
5 a) 10011.011
5 b) 1001011.00010011…….
6 a) 55.765625
6 b) 25.4375

Chapter 01.05 Floating Point Representation of Numbers

Multiple Choice Test
Answers

1. A
2. A
3. B
4. B
5. B
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_floatingpoint.html

Problem Set
1) 0 0 0 1 1 0 0 1
2) -7.75
3) 1 1 1 0 1 0 1 1 1 0
4) -102
5) a) -0.125, 0.125 b) -15, 15 c) 0.125 d) 0 0 0 1 0 1 0 e) 0 0 0 1 1 1 0 f) 0.46875 g) 0.07142. This value is less than the machine epsilon of 0.125. The relative difference between consecutive numbers is always going to be less than the machine epsilon.

Chapter 01.06 Propagation of Errors

Multiple Choice Test

Answers

1. B
2. A
3. C
4. B
5. C
6. D

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_propagationerrors.html

Problem Set

No problem set for this chapter

Chapter 01.07 Taylor Series

Multiple Choice Test

Answers

1. D
2. C
3. C
4. B
5. A
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/01aae/quiz_01aae_taylorseries.html

Problem Set

No problem set for this chapter

Chapter 02.01 Background on Differentiation

Multiple Choice Test

Answers

1. D
2. B
3. C
4. B
5. A
6. A

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/02dif/quiz_dif_background.html

Problem Set

1) 38

2) 30

3) 30

4) $= -\dfrac{5}{(5x-3)^2}$

5) 0.099174

6) 32

7) 8

8) -0.090158

10) $y' = \dfrac{-y^2 - 2xy}{x^2 + 2yx + 2y}$

$y'' = \dfrac{2y\left(2x^4 + 6x^3y + 6x^2y^2 + 3xy^3 - 4y^2 + 3y^3\right)}{\left(x^2 + 2xy + 2y\right)^3}$

11) So the critical points are $x = -5,\ x = -1.5,\ x = 1$.

The maximum is at $x = -5$, minimum is at $x = -1.5$

12) 10.667

13) 4

Chapter 02.02 Differentiation of Continuous Functions

Multiple Choice Test

Answers

1. D
2. B

3. D
4. C
5. C
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/02dif/quiz_dif_continuous.html

Problem Set
1) 148.69
2) a) -1.1657, 0.1657 b) -0.8207, 0.1792 c) -0.99334, 0.0067
3) -1.0003, abs rel approx error =0.0271%
4) a) -0.7143 m/s^2 b) -0.7174 m/s^2 (FDD), -0.7111 m/s^2 (BDD), -0.7143 m/s^2 (CDD)
c) -0.0255 m/s^2 using CDD
5) 0.98327
6) 0.1

Chapter 02.03 Differentiation of Discrete Functions

Multiple Choice Test
Answers
1. D
2. D
3. C
4. C
5. B
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/02dif/quiz_dif_discrete.html

Problem Set
1) a) 5.5556 b) 92 c) Cannot be done
2) In m/s^2 22.704, 25.370, 25.152 True errors 2.4814, -0.18498, 0.032927
3) In m/s^2 22.704, 25.370, 25.152 True errors 2.4814, -0.18498, 0.032927
4) 45.33 m/s from CDD, 54.024m/s if using third order polynomial interpolation
5) -60.442 m/s^2 if using 3rd order polynomial for location. -60.444
6) 257437 kg-m/s if using CDD, if using 3rd order polynomial, 300354 kg-m/s.

Chapter 03.01 Background of Nonlinear Equations

Multiple Choice Test

Answers

1. A
2. B
3. B
4. D
5. B
6. C

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/03nle/background.html

Problem Set

1) -1.5, -1

2) -1+*i*, -1-*i*

3) x=0

4) roots are 0.062378, 0.14636, -0.043737. Only x=0.062378 is acceptable as the root needs to lie between 0 and the diameter, D=0.11m.

5) a) 2 b) 3.3149 s c) 5.0175 s d) Modeling of eqn must be wrong.

6) $-0.4800000000\ 10^{-10}\ Tf^3 - 0.004973504000 + 0.3720000000\ 10^{-7}\ Tf^2 + 0.00007200000000\ Tf = 0$

Chapter 03.03 Bisection Method

Multiple Choice Test

Answers

1. B
2. D
3. C
4. C
5. C
6. C

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/03nle/bisection.html

Problem Set

1)

Iteration #	Root	Approx	True	Rel Approx	Rel True

	Estimate	Error	Error	Error	Error
1	2.05	-	-0.05	-	2.5%
2	1.875	-0.175	0.125	9.33%	6.25%
3	1.9625	0.0875	0.0375	4.45%	1.875%

2) a) 0.055, 0.0825, 0.06875
b) n/a, 33.333%, 20.00%
c) n/a, 0, 0
d) Since the diameter is 0.11m, initial guesses of 0 and 0.11 are good

3)

Iteration	Estimated root	ϵ_a %	$v(t)$(m/s)
1	4.500	-	0.27221
2	2.750	63.663	0.53944
3	3.6250	24.138	0.37247

4) See book
5) The equation has no real roots.
6) 1.25

Chapter 03.04 Newton Raphson Method

Multiple Choice Test
Answers

1. B
2. C
3. C
4. B
5. C
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/03nle/newton.html

Problem Set
1)

Iteration #	Root Estimate	Approx Error	True Error	Rel Approx Error	Rel True Error

1	2.1667	-	-0.1667	-	8.335%
2	2.0064	-0.1603	-0.0064	7.98%	0.32%
3	2.0002	-0.0062	-0.00002	0.31%	0.001%

2. a) 1.5236, 1.6058 b) 0.2260%

3) a) 0.06233, 0.06237, 0.06237
b) n/a, 0.06413%, 0% (0% if only 4 significant digits were carried in the calculations)
c) n/a, 2, 4 (as only 4 significant digits were carried in the calculations)
d) Since the diameter is 0.11m, a value of 0 or 0.11 seems to be a good guess, but these guesses give division by zero. So, 0.055 is a good choice.

4) -0.24696
5) 98.012
6) Takes 6 iterations. Root at end of 6^{th} iteration is 7.100, with absolute relative approx error of 0.014%. Four significant digits were used in the calculations.

Chapter 03.05 Secant Method

Multiple Choice Test
Answers
1. C
2. A
3. A
4. B
5. B
6. C

Chapter 03.06 False Position Method

Multiple Choice Test
Answers
1. B
2. D
3. A
4. A
5. C
6. C

Chapter 04.01 Background on Simultaneous Linear Equations

Note to Students at USC – the answers for Chapters 04.01 to 04.05 are in the book

Multiple Choice Test

Answer

1. D
2. A
3. A
4. A
5. B
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/04sle/quiz_sle_background.html

Problem Set

1) $[B] = \begin{bmatrix} 2 & 1 & 5 & 7 \end{bmatrix}$

2) $[A] = \begin{bmatrix} 1 \\ 8 \\ 9 \\ 5 \end{bmatrix}$

3) $[A] = \begin{bmatrix} 1 & 8 & 6 & 2 \\ 9 & 3 & 4 & 1 \\ 7 & 6 & 2 & 5 \\ 8 & 3 & 6 & 4 \end{bmatrix}$

4) $[A] = \begin{bmatrix} 2 & 4 & 0 & 0 \\ 2 & 3 & 9 & 0 \\ 0 & 0 & 5 & 2 \\ 0 & 0 & 3 & 6 \end{bmatrix}$

5) $[A] = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$

6) $[A]=\begin{bmatrix}1 & 3 & 6 & 0\\ 0 & 5 & 8 & 2\\ 0 & 0 & 4 & 9\\ 0 & 0 & 0 & 2\end{bmatrix}$

7) $[A]=\begin{bmatrix}1 & 0 & 0 & 0\\ 3 & 5 & 0 & 0\\ 9 & 6 & 4 & 0\\ 7 & 8 & 1 & 2\end{bmatrix}$

8) None of them

9a) $=\begin{bmatrix}37 & 10\\ 11 & 33\\ 34 & 39\end{bmatrix}$

9b) $[C]=\begin{bmatrix}12 & -3\\ -4 & 5\\ 4 & 1\end{bmatrix}$

9c) $=\begin{bmatrix}-7 & -4\\ -7 & -8\\ -11 & -13\end{bmatrix}$

10)
$$\begin{matrix} & \begin{matrix}McFat & Burcholestrol & \begin{matrix}Kentucky\\ Sodium\end{matrix}\end{matrix}\\ \begin{matrix}Mechanical\\ Civil\end{matrix} & \begin{bmatrix}116.8 & 116.75 & 120.9\\ 89.37 & 89.61 & 93.19\end{bmatrix}\end{matrix}$$

Thus, Burcholesterol is the cheapest for the mechanical department, and McFat is the cheapest for the civil department.

11) $[C]=\begin{bmatrix}199.4 & -230.6\\ -50.2 & 209.4\\ -58.2 & 219.4\end{bmatrix}$

12) infinite solutions.

13)

14) Yes

15) No

16) $\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & -3\\ 0.06 & 0.08 & 0.11\end{bmatrix}\begin{bmatrix}J\\ C\\ D\end{bmatrix}=\begin{bmatrix}2{,}253{,}453\\ 0\\ 190{,}740.57\end{bmatrix}$

17) $\begin{bmatrix} 0.6666 \\ -0.3333 \\ 0 \end{bmatrix}$

18) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0.5 & 0 & 0 \\ 0 & 0 & 0.25 & 0 \\ 0 & 0 & 0 & 0.20 \end{bmatrix}$

19) $[X] = \begin{bmatrix} 52.5 \\ 49.06 \\ 50.072 \end{bmatrix}$

20) $[A]^{-1} = \begin{bmatrix} -1.666 & 0.6666 & 0 \\ 1.333 & -0.3333 & 0 \\ 0 & 0 & 0.07692 \end{bmatrix}$

Chapter 04.06 Gauss Elimination

Multiple Choice Test

Answers

1. D
2. C
3. A
4. B
5. D
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/04sle/quiz_sle_gaussianelimination.html

Problem Set

1) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ -13 \\ 1 \end{bmatrix}$

2) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3.000 \\ -13.00 \\ 1.000 \end{bmatrix}$

3) -150.05

4) -84

5) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ -13 \\ 1 \end{bmatrix}$

6) $\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 2.998 \\ -12.99 \\ 1.000 \end{bmatrix}$

Chapter 04.07 LU Decomposition

Multiple Choice Test

Answers

1. C
2. A
3. C
4. C
5. B
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/04sle/quiz_sle_ludecomposition.html

Problem Set

1) See book

2) $[L][U] = \begin{bmatrix} 1 & 0 & 0 \\ 1.25 & 1 & 0 \\ 1.5 & 2 & 1 \end{bmatrix} \begin{bmatrix} 4 & 1 & -1 \\ 0 & -0.25 & 3.25 \\ 0 & 0 & -4 \end{bmatrix}$

3) $[\mathrm{A}]^{-1} = \begin{bmatrix} 0.29310 & 0.169379 & -0.025862 \\ 0.1551 & -0.060345 & -0.043103 \\ -0.5 & -0.25 & 0.25 \end{bmatrix}$

4) $[L] = \begin{bmatrix} 1 & 0 & 0 \\ 3 & 1 & 0 \\ 0.5 & -1.1875 & 1 \end{bmatrix}$; $[U] = \begin{bmatrix} 25 & 5 & 4 \\ 0 & -8 & 4 \\ 0 & 0 & 24.75 \end{bmatrix}$

5) Since the $a_{11} = 0$, the first step of Gaussian elimination will involve a division by zero.

6) $[U] = \begin{bmatrix} 4 & 1 & -1 \\ 0 & -0.25 & 3.25 \\ 0 & 0 & -4 \end{bmatrix}$

Chapter 04.08 Gauss Seidel

Multiple Choice Test

Answers

1. B
2. C
3. B
4. C
5. B
6. B

You can see complete solutions by taking the test online

http://numericalmethods.eng.usf.edu/mcquizzes/04sle/quiz_sle_gaussseidel.html

Problem Set

1) $$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 1.0380 \\ 1.9377 \\ -3.0328 \end{bmatrix}$$

The absolute relative approximate error at the end of the third iteration is

$$|\epsilon_a|_1 = \left|\frac{1.0380 - 2.1383}{1.0380}\right| \times 100$$
$$= 105.99\%$$
$$|\epsilon_a|_2 = \left|\frac{1.9377 - 1.8791}{1.9377}\right| \times 100$$
$$= 3.0216\%$$
$$|\epsilon_a|_3 = \left|\frac{-3.0328 - (-2.8700)}{-3.0328}\right| \times 100$$
$$= 5.3676\%$$

The maximum absolute relative approximate error is 105.99%

2) At the end of the third iteration, the estimate of the solution vector is

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -80.180 \\ 133.40 \\ 65.858 \end{bmatrix}$$

The absolute relative approximate error at the end of the third iteration is

$$|\epsilon_a|_1 = \left|\frac{-80.180-(-20.276)}{-80.180}\right|\times 100$$
$$= 74.712\%$$
$$|\epsilon_a|_2 = \left|\frac{133.40-36.550}{133.40}\right|\times 100$$
$$= 72.601\%$$
$$|\epsilon_a|_3 = \left|\frac{65.858-15.118}{65.858}\right|\times 100$$
$$= 77.044\%$$

The maximum absolute relative approximate error is 77.044%.

3) At the end of the third iteration, the estimate of the solution vector is

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} -2.6982 \\ 7.9861 \\ 0.13697 \end{bmatrix}$$

The absolute relative approximate error at the end of first iteration is

$$|\epsilon_a|_1 = \left|\frac{-2.6982-0.027994}{-2.6982}\right|\times 100$$
$$= 101.04\%$$
$$|\epsilon_a|_2 = \left|\frac{7.9861-3.5741}{7.9861}\right|\times 100$$
$$= 55.246\%$$
$$|\epsilon_a|_3 = \left|\frac{-0.13697-(-2.1750)}{-0.13697}\right|\times 100$$
$$= 1688.0\ \%$$

The maximum absolute relative approximate error is 1688.0%

Chapter 04.11 Cholesky and LDL Method

Multiple Choice Test

Answers

1. B
2. D
3. A
4. D
5. C
6. C

7. A
8. D
9. B
10. D
11. A
12. A

Chapter 05.01 Background

Multiple Choice Test

Answers

1. D
2. D
3. D
4. D
5. A
6. B

Chapter 05.02 Direct Method

Multiple Choice Test

Answers

1. D
2. B
3. C
4. D
5. A
6. A

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/05inp/direct.html

Problem Set

1) 23.86 m/s
2) 20.60 m/s
3) 17.30 m/s
4) 18.287s or 22.028 s
5) 24.875 m/s (Intermediate answers a0=25.008, a1=-9.2636; a2=-5.0770 (arguments of sin are radians)
6)

a) 393.69 m/s
b) 392.19m/s, 0.38247%, 2 sig digits
c) 392.05 m/s, 0.035561%, 3 sig digits
d) Exact 392.08 m/s

Interpolant	True Error (E_t)
1st order	-1.61
2nd order	-0.11
3rd order	.03

7) a) 30.914 m/s^2
b) 29.784 m/s^2
c) Method 1: 2672.3 m by integrating 3rd order polynomial interpolant
Method 2: 2704.2 m by Trapezoidal rule with unequal segments
Other methods are possible too – *average method is unacceptable*.

Chapter 05.03 Newton's Divided Difference Polynomial Method

Multiple Choice Test
Answers

1. B
2. C
3. B
4. C
5. C
6. A

Chapter 05.04 Lagrange Method of Interpolation

Multiple Choice Test
Answers

1. C
2. D
3. B
4. B
5. C
6. A

Chapter 05.05 Spline Interpolation

Multiple Choice Test
Answers

1. B
2. C
3. C
4. C
5. C
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/05inp/spline.html

Problem Set

1 a)
$$\begin{bmatrix} 4 & 2 & 1 & 0 & 0 & 0 \\ 9 & 3 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 9 & 3 & 1 \\ 0 & 0 & 0 & 36 & 6 & 1 \\ 6 & 1 & 0 & -6 & -1 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} a_1 \\ b_1 \\ c_1 \\ a_2 \\ b_2 \\ c_2 \end{bmatrix} = \begin{bmatrix} 4.75 \\ 5.25 \\ 5.25 \\ 45 \\ 0 \\ 0 \end{bmatrix}$$

b)

i	a_i	b_i	c_i
1	0	0.5	3.75
2	4.25	-25	42

$$y(x) = 0.5x + 3.75, \qquad 2 \le x \le 3$$
$$= 4.25x^2 - 25x + 42, \qquad 3 \le x \le 6$$

c) 7.08

2)

a)

$c = 0.8125$

$g = -1.625$

$h = 2.8125$

$j = 23.5$

$k = -228.5$

$l = 570$

b) linear=4.375; quadratic=3.955

3) g=-52.6391

4) 0.23133

5) 5.6965

6) 87.052 (getting 87 as the answer is wrong)

Chapter 06.01 Background

Multiple Choice Test

Answers

1. B
2. D
3. D
4. D
5. B
6. A

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/06reg/quiz_reg_background.html

Chapter 06.03 Linear Regression

Multiple Choice Test

Answers

1. C
2. C
3. B
4. C
5. C
6. A

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/06reg/quiz_reg_linear.html

Problem Set

1) -1
2) 30 N/m
3) 0.06567+1.7750θ
4) 16.55 N/m
5) 0.994
6) 182.8 GPa

Chapter 06.04 Nonlinear Regression

Multiple Choice Test

Answers

1. B
2. A
3. B
4. B
5. D
6. C

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/06reg/quiz_reg_nonlinear.html

Problem Set

1) $30.213\ p^{0.49101}$

2) $0.97450\ N/m^2$

3) Follow the hint

4) $K_1=5.8406$, $K_2= 4.9439 \times 10^{-4}$ (note the units for strain for which this K_2 is valid is μin/in.

5) $k_1=1.2053$, $k_2= 0.13395$

6)

a) $461.85/(1+0.29069t)$

b) 314.30 months

7) $a = \dfrac{\sum_{i=1}^{n} v_i t_i^{\,2}}{\sum_{i=1}^{n} t_i^4}$

8) $p=94.136e^{0.1199t}$

9) $W=-0.03642t^2+1.6659t+7.7810$; $W(360)=-4110.2$

10) $A=155.02$

11) 52.53 km

Chapter 06.05 Adequacy of Regression Models

Problem Set

1)

a) $3.7306\ ft^3/s$, 4.34%

b) $3.9496\ ft^3/s$, 1.27%

c) $3.9322\ ft^3/s$, 0.83%

2) 0.69441

3) (C)

4) All are in range

5) Check residual plot to reject it.

6) Use v=a*(1-r^2/0.5^2)

a) 6.4082 ft^3/s,

b) -24.032 ft^2/s

c) get 5.0266 by average method, get 3.9322 by integrating formula

7)

a) -0.1219E-10*T^2+0.6313E-8*T+0.6023E-5

b) 0.0137”, not enough

c) 0.0244”, enough

Chapter 07.01 Background

Multiple Choice Test

Answers

1. A
2. D
3. B
4. C
5. C
6. D

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/07int/background.html

Problem Set

1) 0
2) 504.04
3) 0.27058
4) 0.0031019 in
5) 163.91 ^{o}F
6) 51.750

Chapter 07.02 Trapezoidal Rule

Multiple Choice Test

Answers

1. A
2. C
3. C
4. C
5. B
6. A

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/07int/trapcontinuous.html

Problem Set

1) 14.033
2) 33.875
3)

a) 949.32 m
b) 1025.1 m
c) 75.790 m
d) 0.073933
e) 7.3933 %
f) 1004.4 m
g) 5.4865 %
h) 0

4) 0.42101

5)

a) 0.10075
b) 0.12778
c) 0.10719
d) -0.027028, -0.00644

6) ¼

7) 2.0280 m

8) 4.7386

9) 0.38887

10) 187.5

11) $(b^3-a^3)/(3a^2)$

Chapter 07.03 Simpson's 1/3 Rule

Multiple Choice Test

Answers

1. C
2. B
3. B
4. C
5. B
6. B

Chapter 07.04 Romberg Rule

Multiple Choice Test

Answers

1. B
2. D
3. B
4. C
5. C
6. A

Chapter 07.05 Gauss Quadrature

Multiple Choice Test

Answers

1. B
2. D
3. A
4. B
5. C
6. D

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/07int/gaussquadrature.html

Problem Set

1)
a) 0.35285
b) 0.45812

2)
a) 1034.6 m
b) 1025.1 m
c) -9.4458 m
d) -0.0092144
e) 0.92144%
f) 1026.2 m

3)
a) 2.2049, 0%
b) 65.2 m, 0%

4) $c_1 = b - a,\ x_1 = \dfrac{b+a}{2}$

5)

$$x_1 = \frac{2\left(b^2 + a^2 + ab\right)}{3\left(b + a\right)}$$

$$c_1 = \frac{3\left(b - a\right)\left(b + a\right)^2}{4\left(b^2 + a^2 + ab\right)}$$

6)

a) $c_1 = -\frac{1}{6}\frac{-ab - b^2 + 2a^2}{a}$, $c_2 = -\frac{1}{6}\frac{a^2 + ab - 2b^2}{b}$

b) 447.50 by both formula and exact

c) 12.976 by formula; 10 exact

Chapter 07.06 Discrete Data Integration

Problem Set

1) 215.5

2) 139.23 by trapezoidal rule with unequal segments

3) 94.25 m^3

4) 97 m^3

5) 3.8477 ft^3/s by trapezoidal rule with unequal segments

6)

a) -0.14238"

b) No, needed contraction is 0.015"

c) Not a good assumption as the coefficient of thermal expansion is a function of temperature.

d) trapezoidal rule with unequal segments=-0.12872"; polynomial regression=-0.012897"

e) cool in liquid nitrogen; you will get an estimated contraction of -0.023627"

Chapter 07.07 Improper Integrals

Problem Set

1) Answers will be different. We broke the integral into two limits of integration: [-2,2], [2,10]. Approximated upper limit as 10. Used 2-pt rule on each integral. Answer: -7.5330. Exact is -7.3890

2) Answers will be different. I made y=1/(x+3) change of variables. Got answer as 0.59716

3) 1.8415, exact=1.7683

4) Answers will be different. We made y=1/x change of variables. Got 0.45455. Exact is 0.46210.

5) Errata. Lower limit is 2. Use 2-pt rule and got value as 4.9520. Exact =6.

6) Answers will be different. y=1/(1+t) change of variables. Broke integral into two limits of integration. [-infinity,0], [0,infinity]. Applied 2 pt rule for both. Got 0.59695.

Chapter 07.08 Simpson 3/8 rule

Multiple Choice Test

Answers

1. A
2. C
3. B
4. C
5. A
6. C

Chapter 08.01 Background of ODEs

Multiple Choice Test

Answers

1. A
2. C
3. C
4. A
5. B
6. D

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/08ode/ode_background.html

Problem Set

1) $y = 6.875e^{-0.2x} - 1.875e^{-x}$

2)

a) 5

b) -7

c) 0.14699

d) -0.20872

3) $y = 31e^{-2x} - 24.25e^{-3x} + 0.25e^{x}$

4) $y = e^{-0.75x}(5.292237\cos x + 6.859588\sin x) + 0.109589\sin x - 0.292237\cos x$

5) $y = e^{-2x}(6.9986\cos 3x + 8.3403\sin 3x) + 0.038462x^2 - 0.023669x + 0.0013655$

6)

$$5.8043\ln(\theta + 2.696.3) + 7.0370\ln(\theta^2 - 2396.4\theta + 6.5478\times 10^6)$$

a)

$$-2.104\tan^{-1}\left(\frac{2261.81}{\theta - 1198.2}\right) - 19.878(\theta - 300) = t + 5.1921$$

b) 1369.6 K

c)

i) 2500K

ii) -220.72 K/s

iii) 1391.3 W

iv) 1382.3 W

v) -2773.6 W

d) No, as the rate of heat lost due to convection and radiation is of the same order.

Chapter 08.02 Euler's Method

Multiple Choice Test

Answers

1. B
2. A
3. B
4. A
5. C
6. B

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/08ode/eulers_method.htm

Problem Set

1) 329.45

2)

a) 3.371

b) -5.0539

c) 0.14699

d) 2197.6%

e) -0.20872

f) 2321.4%

3)

a) 165.81, true error=219.06

b) 258.42, true error=126.45

4) 165.81, same as LRAM

5)

a) 2.7737 m

b) 15.182 minutes

c) part (a) exact 2.9371 m, 5.5623%
part (b) exact 19.415 minutes, 21.802%

6)

a) 2500 K, -220.72 K/s, 1391.3 W, 1382.3 W, -2773.6 W

b) 1252.3 K, -54.568 K/s, 87.344 W, 598.38 W, -685.72 W

c) No as rate of heat lost due to convection and radiation is of same order.

d) 2.2654 s

Chapter 08.03 Runge-Kutta 2nd order method

Multiple Choice Test

Answers

1. B
2. A
3. C
4. A
5. B
6. A

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/08ode/runge_2nd_method.htm

Problem Set

1) $y(6) \approx -23684$

2)

a) $y(2.5) \approx 3.5433$

b) -5.3031

c) 0.14699

d) 2310.6%

e) -0.20872

f) 2440.8%

3)

a) 454.46, 18.083%

b) 402.74, 4.6441%

4) 454.46, MRAM

5)

a) 2.9282 m

b) 19.248 min

c) part (a) h=2.9371, 0.29795%

part(b) t=1164.87 s

6)

a) 2500 K, -220.72 K/s, 1391.3 W, 1382.3 W, -2773.6 W

b) 1381.9 K, -64.41 K/s, 129.63 W, 679.78 W, -809.41 W

c) No as rate of heat lost due to convection and radiation is of same order.

d) 3.1591 s

Chapter 08.04 Runge-Kutta 4th order method

Multiple Choice Test

Answers

1. B
2. C
3. A
4. C
5. B
6. A

Chapter 08.05 Higher Order/Coupled ODEs

Problem Set

3)

a) 3, 2 , -2

b) 3.8750, 0.81970, -3.2685

c) 3.6958, 0.69213, -3.0893

4) 3.7067 m, 0.67811 m/s, -3.1001 m/s^2

Chapter 08.06 Shooting Method

Multiple Choice Test

Answers

1. A
2. A
3. B
4. C
5. A
6. B

Chapter 08.07 Finite Difference Method

Multiple Choice Test

Answers

1. A
2. B
3. D
4. D
5. A
6. B

You can see complete solutions by taking the test online
http://numericalmethods.eng.usf.edu/mcquizzes/08ode/finite_dif_method.html

Chapter 08.07 Finite Difference Methods

Problem Set

1.

(a) $u_0 = u(5) = 0.004$

$u_1 = u(6.7) = 0.0034196$

$u_2 = u(8.4) = 0.0031322$

$u_3 = u(10.1) = 0.003$

(b) 0.83352%

2.

(a) $u_0 = u(5) = 0.004$

$u_1 = u(6.7) = 0.0033904$

$u_2 = u(8.4) = 0.0031117$

$u_3 = u(10.1) = 0.003$

(b) 0.17158%

3(a) $u_0 = u(5) = 0.004$

$u_1 = u(6.7) = 0.0033532$

$u_2 = u(8.4) = 0.0030864$

$u_3 = u(10.1) = 0.003$

(b) 0.64331%

4 (a) $y = 4 \times 10^{-5} x^3 - 8 \times 10^{-7} x^4 - 0.01245x$

(b) $y_0 = y(0) = 0$ ft

$y_1 = y(8.3333) = -0.092593$ ft

$y_2 = y(16.666) = -0.092593$ ft

$y_3 = y(25) = 0$ ft

(c) At $x = 8.3333$, 9.0909%

At $x = 16.667$, 9.0909%

Chapter 11.02 Continuous Fourier Series
Multiple Choice Test

Answers
1. A
2. B
3. B
4. D
5. C
6. C

Chapter 11.03 Fourier Transform Pair: Frequency and Time Domain
Multiple Choice Test

Answers
1. D
2. C
3. B
4. D
5. B
6. C

Chapter 11.04 Discrete Fourier Transform
Multiple Choice Test

Answers
1. B
2. C
3. D
4. A
5. B
6. D

Chapter 11.05 Informal Development of Fast Fourier Transform
Multiple Choice Test

Answers
1. D
2. C
3. A
4. B
5. D
6. A

Chapter 11.06 Theoretical Development of Fast Fourier Transform

Multiple Choice Test

Answers

1. C
2. C
3. B
4. D
5. B
6. A