Chapter 22 Solution

Exercise 97

1. (a) (i) $a = 0.2$ A1 N1
$b = 52.4$ A1 N1

(ii) The estimated final exam score
$= 0.2(85) + 52.4$ (A1) for substitution
$= 69.4$ A1 N2
[4]

(b) (i) $r = 0.1832541665$
$r = 0.183$ A1 N1

(ii) Weak, Positive A2 N2
[3]

2. (a) (i) $a = -2.085714286$
$a = -2.09$ A1 N1
$b = 96.0952381$
$b = 96.1$ A1 N1

(ii) The estimated temperature
$= -2.085714286(9) + 96.0952381$ (A1) for substitution
$= 77.32380953$
$= 77.3^{\circ}\text{C}$ A1 N2
[4]

(b) (i) $r = -0.6074200776$
$r = -0.607$ A1 N1

(ii) Moderate, Negative A2 N2
[3]

3. (a) (i) $a = 0.7121409922$
$a = 0.712$ A1 N1
$b = 7.222584856$
$b = 7.22$ A1 N1

(ii) The estimated Physics test score
$= 0.7121409922(25) + 7.222584856$ (A1) for substitution
$= 25.02610966$
$= 25.0$ A1 N2

[4]

(b) -0.989 A1 N1

[1]

(c) The estimated difference
$= 0.18(3)$ (M1) for valid approach
$= 0.54$ A1 N2

[2]

4. (a) (i) $r = -0.9565269783$
$r = -0.957$ A1 N1

(ii) $a = -0.7459677419$
$a = -0.746$ A1 N1
$b = 6.748252688$
$b = 6.75$ A1 N1

[3]

(b) 0.178 A1 N1

[1]

(c) The estimated average number of hours
$= 0.53(2.7)$ (A1) for substitution
$= 1.431$ hours A1 N2

[2]

Exercise 98

1. (a) (i) $a = 0.1566210046$
$a = 0.157$ A1 N1
$b = -5.752968037$
$b = -5.75$ A1 N1

(ii) a represents the average increase of university entrance mark when the public exam score is increased by 1. A1 N1

[3]

(b) The estimated university entrance mark
$= 0.1566210046(180) - 5.752968037$ (A1) for substitution
$= 22.43881279$
$= 22.4$ A1 N2

[2]

2. (a) (i) $a = 3.422857143$
$a = 3.42$ A1 N1
$b = 1.553333333$
$b = 1.55$ A1 N1

(ii) b represents the expected sales in 2011. A1 N1

[3]

(b) The estimated sales
$= 3.422857143(2.5) + 1.553333333$ (A1) for substitution
$= 10.11047619$
$= 10.1$ million dollars A1 N2

[2]

3. (a) (i) $a = 5.978021978$
$a = 5.98$ A1 N1
$b = 21.58241758$
$b = 21.6$ A1 N1

(ii) a represents the average increase of number of visitors when the maximum temperature is increased by 1 degree Celsius. A1 N1
b represents the expected number of visitors when the maximum temperature is zero degree Celsius. A1 N1

[4]

(b) The estimated number of visitors
$= 5.978021978(4) + 21.58241758$ (A1) for substitution
$= 45.49450549$
$= 45.5$ A1 N2

[2]

4. (a) (i) $a = 6.845588235$

$a = 6.85$ A1 N1

$b = 24.29338235$

$b = 24.3$ A1 N1

(ii) a represents the average increase of the hardness of a metal ingot when its breaking strength is increased by 1 tonne per cm. A1 N1

b represents the hardness of a metal ingot when its breaking strength is zero tonne per cm. A1 N1

[4]

(b) The estimated hardness

$= 6.845588235(6) + 24.29338235$ (A1) for substitution

$= 65.36691176$

$= 65.4$ A1 N2

[2]

Exercise 99

1. (a) $a = -1.83140966$

$a = -1.83$ A1 N1

$b = 2164.965538$

$b = 2160$ A1 N1

[2]

(b) $e = 995$ M1A1 N2

$f = 638.8333333$

$f = 639$ A1 N1

[3]

2. (a) $a = 1.231628454$

$a = 1.23$ A1 N1

$b = -2.366255144$

$b = -2.37$ A1 N1

[2]

(b) $m = 6.6$ M1A1 N2

$n = 7.28$ A1 N1

[3]

3. (a) $a = -0.0003105590062$

$a = -0.000311$ A1 N1

$b = 7.541614907$

$b = 7.54$ A1 N1

[2]

(b) 1 A1 N1

[1]

(c) $d = 69.8203125$ M1

$d = 69.8$ A1 N2

[2]

4. (a) $a = 0.2785493827$

$a = 0.279$ A1 N1

$b = 66.17052469$

$b = 66.2$ A1 N1

[2]

(b) 1 A1 N1

[1]

(c) $x = 67$ A2 N2

[2]

Exercise 100

1. (a) (i) $r = 0.8597409868$ (M1) for valid approach
$r = 0.860$ A1 N2

(ii) $a = 0.0036032243$
$a = 0.00360$ A1 N1
$b = -0.6258602021$
$b = -0.626$ A1 N1
[4]

(b) The estimated monthly honey production
$= 0.0036032243(700) - 0.6258602021$ (A1) for substitution
$= 1.896396808$ (A1) for correct value
$= 1.9$ kg A1 N3
[3]

(c) The monthly honey production
$= 1.896396808 \times (1 + 2\%)^{12}$ (M1)(A1) for substitution
$= 1.896396808 \times 1.02^{12}$ (A1) for simplification
$= 2.405089691$
$= 2.41$ kg A1 N2
[4]

(d) $1.896396808 \times (1 + 2\%)^{t} = 3$ (M1) for setting equation
$1.896396808 \times 1.02^{t} - 3 = 0$ (A1) for simplification
$t = 23.161402$ (A1) for correct value
Thus, the year is 2019. A1 N2
[4]

2. (a) (i) $r = 0.9822040739$ (M1) for valid approach

$r = 0.982$ A1 N2

(ii) $a = 2.5625$ A1 N1

$b = 6.375$ A1 N1

[4]

(b) The estimated monthly honey production

$= 2.5625(24) + 6.375$ (A1) for substitution

$= 67.875$ (A1) for correct value

$= 68$ kg A1 N3

[3]

(c) The monthly consumption of chicken food

$= 67.875 \times (1 + 5\%)^6$ (M1)(A1) for substitution

$= 67.875 \times 1.05^6$ (A1) for simplification

$= 90.95899161$

$= 91.0$ kg A1 N2

[4]

(d) $67.875 \times (1 + 5\%)^t = 100$ (M1) for setting equation

$67.875 \times 1.05^t - 100 = 0$ (A1) for simplification

$t = 7.9422239$ (A1) for correct value

Thus, the time is February 2019. A1 N2

[4]

3. (a) (i) $r = 0.9823629148$ (M1) for valid approach

$r = 0.982$ A1 N2

(ii) $a = 14.06320542$

$a = 14.1$ A1 N1

$b = 188.3205418$

$b = 188$ A1 N1

[4]

(b) The estimated number of wolves

$= 14.06320542(11) + 188.3205418$ (A1) for substitution

$= 343.0158014$ (A1) for correct value

$= 343$ A1 N3

[3]

(c) $f(10) = 930$ (M1) for setting equation

$930 = 50(e^{0.01k(10)} + 2)$ (A1) for substitution

$18.6 = e^{0.1k} + 2$

$e^{0.1k} = 16.6$

$0.1k = \ln 16.6$

$k = 28.09402695$

$k = 28.1$ A1 N2

[3]

(d) $14.06320542t + 188.3205418$

$= 50(e^{0.01(28.09402695)t} + 2)$ (M1) for setting equation

$14.06320542t + 188.3205418 = 50e^{0.2809402695t} + 100$ (A1) for correct working

$50e^{0.2809402695t} - 14.06320542t - 88.3205418 = 0$

$t = 3.6593917$ (A1) for correct value

Thus, the year is 1984. A1 N2

[4]

4. (a) (i) $r = -0.925877311$ (M1) for valid approach

$r = -0.926$ A1 N2

(ii) $a = -1.172413793$

$a = -1.17$ A1 N1

$b = 58.75862069$

$b = 58.8$ A1 N1

[4]

(b) The estimated number of breaths per minute

$= -1.172413793(12) + 58.75862069$ (A1) for substitution

$= 44.68965517$ (A1) for correct value

$= 45$ A1 N3

[3]

(c) $v(8) = 75$ (M1) for setting equation

$75 = \frac{10}{e^{8k}} + 70$ (A1) for substitution

$5 = \frac{10}{e^{8k}}$

$e^{8k} = 2$

$8k = \ln 2$

$k = 0.0866433976$

$k = 0.0866$ A1 N2

[3]

(d) $\frac{10}{e^{0.0866433976t}} + 70$ (M1) for setting equation

$= 1.5(-1.172413793t + 58.75862069)$

$\frac{10}{e^{0.0866433976t}} + 70 = -1.75862069t + 88.13793104$ (A1) for correct working

$\frac{10}{e^{0.0866433976t}} + 1.75862069t - 18.13793104 = 0$

$t = 7.2902653$ (A1) for correct value

Thus, the time is after 7.29 minutes. A1 N2

[4]