**Additional data sets for Spearman’s Rank practice - ANSWERS**

1. **Total alkalinity and dissolved inorganic carbon**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sample date** | **Total alkalinity (umol/kg)** | **Rank** | **Dissolved inorganic carbon (umol/kg)** | **Rank** | ***d*** | ***d2*** |
| 17/03/10 | 2137 | 8 | 2003 | 15 | 7 | 49 |
| 19/03/10 | 2114 | 19 | 2000 | 19 | 0 | 0 |
| 21/03/10 | 2134 | 9.5 | 2006 | 14 | 4.5 | 29.25 |
| 23/03/10 | 2129 | 11.5 | 2001 | 18.5 | 7 | 49 |
| 25/03/10 | 2123 | 14 | 2001 | 18.5 | 4.5 | 20.25 |
| 27/03/10 | 2117 | 17 | 2002 | 16.5 | -0.5 | 0.25 |
| 29/03/10 | 2142 | 4.5 | 2008 | 11.5 | 7 | 49 |
| 31/03/10 | 2109 | 20 | 2002 | 16.5 | -3.5 | 12.25 |
| 02/04/10 | 2115 | 18 | 2009 | 10 | -8 | 64 |
| 04/04/10 | 2121 | 15.5 | 2007 | 13 | -2.5 | 6.25 |
| 06/04/10 | 2121 | 15.5 | 2013 | 7 | -8.5 | 72.25 |
| 08/04/10 | 2128 | 13 | 2008 | 11.5 | -1.5 | 2.25 |
| 10/04/10 | 2129 | 11.5 | 2010 | 8.5 | -3 | 9 |
| 12/04/10 | 2155 | 1 | 2010 | 8.5 | 7.5 | 56.25 |
| 14/04/10 | 2142 | 4.5 | 2023 | 5 | 1.5 | 2.25 |
| 16/04/10 | 2144 | 2 | 2018 | 6 | 4 | 16 |
| 18/04/10 | 2138 | 7 | 2029 | 1 | -6 | 36 |
| 20/04/10 | 2134 | 9.5 | 2025 | 2.5 | -7 | 49 |
| 22/04/10 | 2143 | 3 | 2024 | 4 | 1 | 1 |
| 24/04/10 | 2140 | 6 | 2025 | 2.5 | -3.5 | 12.25 |

|  |  |
| --- | --- |
| Σ*d2* | 526.5 |

$$r=1- \frac{6\sum\_{}^{}d^{2}}{n^{3}-n}$$

$$r=1- \frac{6 ×526.5}{8000-20}$$

$$r=1- \frac{3159}{7800}$$

$r=1- 0.396$ $r= 0.60$

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1. **Temperature and salinity**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sample date** | **Temperature (°C)** | **Rank** | **Salinity (parts per thousand ‰)** | **Rank** | ***d*** | ***d2*** |
| 17/03/10 | -1.644 | 7 | 29.94 | 19.5 | 12.5 | 156025 |
| 19/03/10 | -1.644 | 7 | 29.94 | 19.5 | 12.5 | 156025 |
| 21/03/10 | -1.644 | 7 | 30.04 | 15 | 8 | 64 |
| 23/03/10 | -1.643 | 5 | 30.23 | 7.5 | 2.5 | 6.25 |
| 25/03/10 | -1.641 | 2.5 | 30.46 | 1 | -1.5 | 2.25 |
| 27/03/10 | -1.640 | 1 | 29.98 | 17 | 16 | 256 |
| 29/03/10 | -1.641 | 2.5 | 29.99 | 16 | 13.5 | 182.25 |
| 31/03/10 | -1.642 | 4 | 29.97 | 18 | 14 | 196 |
| 02/04/10 | -1.647 | 11 | 30.11 | 13 | 2 | 4 |
| 04/04/10 | -1.646 | 10 | 30.08 | 14 | 4 | 16 |
| 06/04/10 | -1.649 | 12.5 | 30.30 | 3 | -9.5 | 90.25 |
| 08/04/10 | -1.649 | 12.5 | 30.12 | 12 | -0.5 | 0.25 |
| 10/04/10 | -1.645 | 9 | 30.16 | 10.5 | 1.5 | 2.25 |
| 12/04/10 | -1.651 | 15 | 30.16 | 10.5 | -4.5 | 20.25 |
| 14/04/10 | -1.652 | 17 | 30.23 | 7.5 | -9.5 | 90.25 |
| 16/04/10 | -1.652 | 17 | 30.19 | 9 | -8 | 64 |
| 18/04/10 | -1.652 | 17 | 30.26 | 5.5 | -11.5 | 132.25 |
| 20/04/10 | -1.654 | 19.5 | 30.26 | 5.5 | -14 | 196 |
| 22/04/10 | -1.650 | 14 | 30.34 | 2 | -12 | 144 |
| 24/04/10 | -1.654 | 19.5 | 30.28 | 4 | -15.5 | 240.25 |

|  |  |
| --- | --- |
| Σ*d2* | 2019 |

$$r=1- \frac{6\sum\_{}^{}d^{2}}{n^{3}-n}$$

$$r=1- \frac{6 ×2019}{8000-20}$$

$$r=1- \frac{12114}{7800}$$

$r=1- 1.518$ $r= -0.52$