**A-level Maths, Half-term 2 Assessment**

**1 a** On a coordinate grid (*x* and *y* axes running from −6 to 6), shade the region   
comprising all points whose coordinates satisfy the inequalities   
*y* ≤ 2*x* + 5, 2*y* + *x* ≤ 6 and *y* ≥ 2 **(3 marks)**

**b** Work out the area of the shaded region. **(5 marks)**

**2** **a** Find an equation of the straight line passing through the points with coordinates  
(4, −7) and (−6, 11), giving your answer in the form ,where *a*, *b*  
and *c* are integers. **(3 marks)**

The line crosses the *x*-axis at point *A* and the *y*-axis at point *B* and *O* is the origin.

**b** Find the area of triangle *AOB*. **(3 marks)**

**3 a** Find thefirst four terms, in ascending powers of *x*, of the binomial expansion   
of  **(4 marks)**

Given that the coefficient of the *x*3 term in the expansion is −84

**b i** Find the value of *p*. **(2 marks)**

**ii** Find the numerical values for the coefficients of the *x* and *x*2 terms. **(2 marks)**

**4** where *p* and *q* are constants

Given that f(5) = 0 and f(−3) = 8

**a** find the values of *p* and *q*. **(7 marks)**

**b** factorise f(*x*) completely. **(5 marks)**

**5** The table shows the daily mean temperatures in °C at Perth Airport for the first 20 days in May 1987.

The data is taken from the large data set.

|  |  |
| --- | --- |
| Date | Daily mean temperature (°C) |
| 01/05/1987 | 14.9 |
| 02/05/1987 | 13.7 |
| 03/05/1987 | 15.3 |
| 04/05/1987 | 16.9 |
| 05/05/1987 | 18.4 |
| 06/05/1987 | 21.6 |
| 07/05/1987 | 20.4 |
| 08/05/1987 | 16.6 |
| 09/05/1987 | 14.6 |
| 10/05/1987 | 10.0 |
| 11/05/1987 | 11.5 |
| 12/05/1987 | 12.3 |
| 13/05/1987 | 12.9 |
| 14/05/1987 | 13.1 |
| 15/05/1987 | 13.8 |
| 16/05/1987 | 14.8 |
| 17/05/1987 | 14.5 |
| 18/05/1987 | 13.5 |
| 19/05/1987 | 14.5 |
| 20/05/1987 | 13.8 |

**a** Describe the type of data represented by daily mean temperature. **(1 mark)**

Jennifer is investigating the daily temperature at Perth. She wants to select a sample of size 5 from the daily temperatures at Perth from the first 20 days in May 1987.

**b** Describe what Jennifer could use as the sampling frame. **(1 mark)**

**c** Describe the type of sample Jennifer could take and explain how she could collect her sample.

**(2 marks)**

Sally is investigating rainfall in Leeming in 1987.

The large data set provides data for 184 consecutive days in 1987.

**d** Describe how Sally could take a systematic sample of 30 days from the data for Leeming in 1987.

**(3 marks)**

**e** Explain why Sally’s sample would not necessarily give her 30 data points for her investigation.

**(1 mark)**

**6** A random sample of distances travelled to work for 120 commuters from a train station in Devon is recorded. The distances travelled, to the nearest mile, are summarised below.

|  |  |
| --- | --- |
| **Distance (to the nearest mile)** | **Number of commuters** |
| 0–9 | 10 |
| 10–19 | 19 |
| 20–29 | 43 |
| 30–39 | 25 |
| 40–49 | 8 |
| 50–59 | 6 |
| 60–69 | 5 |
| 70–79 | 3 |
| 80–89 | 1 |

For this distribution:

**a** estimate the median. (**2 marks**)

The mid-point of each class was represented by *x* and its corresponding frequency by *f*. The mid-point of the lowest classwas taken to be4.75 giving:

Σ*fx* = 3552.5 and Σ*fx*2 = 138 043.125

**b** Estimate the mean and the standard deviation of this distribution. (**3 marks**)

**c** Explain why the median is less than the mean for these data. (**1 mark**)

**d** For a second random sample of 120 commuters travelling to work from a train station in Greater London, the mean distance travelled to work is 15.6 miles with standard deviation 21.2 miles. Compare the measures of location and spread for the distance travelled to work for the two samples, giving possible reasons for any differences. (**4 marks**)

**END OF TEST**

**TOTAL MARKS 52**

MARK SCHEME

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q** | **Scheme** | | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **1a** | **Figure 5**  cid:image001.png@01D2F97F.B27153E0 | Graph of *y* = 2*x* + 5 drawn. | **B1** | 1.1b | 4th  Represent linear and quadratic inequalities on graphs |
| Graph of 2*y* + *x* = 6 drawn. | **B1** | 1.1b |
| Graph of *y* = 2 drawn onto the coordinate grid and the triangle correctly shaded. | **B1** | 2.2a |
|  | | **(3)** |  |  |
| **1b** | Attempt to solve *y* = 2*x* + 5 and 2*y* + *x* = 6 simultaneously for *y*. | | **M1** | 2.2a | 5th  Solve problems involving linear and quadratic inequalities in context |
| *y* = 3.4 | | **A1** | 1.1b |
| Base of triangle = 3.5 | | **B1** | 2.2a |
| Area of triangle =  × (“3.4” – 2) × 3.5 | | **M1** | 2.2a |
| Area of triangle is 2.45 (units2). | | **A1** | 1.1b |
|  | | **(5)** |  |  |
| **(8 marks)** | | | | | |
| **Notes**  **1b**  It is possible to find the area of triangle by realising that the two diagonal lines are perpendicular and therefore finding the length of each line using Pythagoras’ theorem. Award full marks for a correct final answer using this method.  In this case award the second and third accuracy marks for finding the lengthsand | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **2a** |  | **B1** | 1.1b | 2nd  Find the equation of a straight line given two points. |
| Correct substitution of (4, −7) or (−6, 11) and their gradient into *y* = *mx* + *b* or *y* − *y1* = *m*(*x* − *x*1) o.e. to find the equation of the line. For example,  or or or . | **M1** | 1.1b |
| 5*y* + 9*x* − 1 = 0 or −5*y* − 9*x* + 1 = 0 only | **A1** | 1.1b |
|  | **(3)** |  |  |
| **2b** | so. Award mark for seen. | **B1** | 1.1b | 3rd  Solve problems involving length and area in the context of straight line graphs. |
| so . Award mark for  seen. | **B1** | 1.1b |
| Area = | **B1** | 1.1b |
|  | **(3)** |  |  |
| **(6 marks)** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **3a** | States or implies the expansion of a binomial expression to the 9th power, up to and including the *x*3 term.    or | **M1** | 1.1a | 5th  Use the binomial expansion to find arbitrary terms for positive integer n |
| Correctly substitutes 2 and *px* into the formula. | **M1** | 1.1b |
| Makes an attempt to simplify the expression (at least one power of 2 calculated and one bracket expanded correctly). | **M1dep** | 1.1b |
| States a fully correct answer: | **A1** | 1.1b |
|  | **(4)** |  |  |
| **3bi** | States that | **M1ft** | 2.2a | 5th  Understand and use the general binomial expansion for positive integer n |
| Correctly solves for *p:* | **A1ft** | 1.1b |
| **3bii** | Correctly find the coefficient of the *x* term: | **B1ft** | 1.1b | 5th  Understand and use the general binomial expansion for positive integer n |
| Correctly find the coefficient of the *x*2 term: | **B1ft** | 1.1b |
|  |  | **(4)** |  |  |
| **(8 marks)** | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **4a** | Makes an attempt to interpret the meaning of f(5) = 0. For example, writing 125 + 25 + 5*p* + *q* = 0 | **M1** | 2.2a | 5th  Solve non-linear simultaneous equations in context |
| 5*p* + *q* = −150 | **A1** | 1.1b |
| Makes an attempt to interpret the meaning of f(−3) = 8.  For example writing −27 + 9 – 3*p* + *q* = 8 | **M1** | 2.2a |
| −3*p* + *q* = 26 | **A1** | 1.1b |
| Makes an attempt to solve the simultaneous equations. | **M1ft** | 1.1a |
| Solves the simultaneous equations to find that *p* = −22 | **A1ft** | 1.1b |
| Substitutes their value for *p* to find that *q* = −40 | **A1ft** | 1.1b |
|  | **(7)** |  |  |
| 4**b** | Draws the conclusion that (*x* – 5) must be a factor. | **M1** | 2.2a | 5th  Divide polynomials by linear expressions with a remainder |
| Either makes an attempt at long division by setting up the long division, or makes an attempt to find the remaining factors by matching coefficients. For example, stating:    (ft their −22 or −40) | **M1ft** | 1.1b |
| For the long division, correctly finds the the first two coefficients.  For the matching coefficients method, correctly deduces that  *a* = 1 and *c* = 8 | **A1** | 2.2a |
| For the long division, correctly completes all steps in the division.  For the matching coefficients method, correctly deduces that  *b* = 6 | **A1** | 1.1b |
| States a fully correct, fully factorised final answer:  (*x* – 5)(*x* + 4)(*x* + 2) | **A1** | 1.1b |
|  | **(5)** |  |  |
| **(12 marks)** | | | | |
| **Notes**  Award ft through marks for correct attempt/answers to solving their simultaneous equations.  In part **b** other algebraic methods can be used to factorise:  *x* – 5 is a factor (M1)  by balancing (M1)  by factorising (M1)  by factorising (A1 A1) (i.e. A1 for each factor other than (x – 5)) | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q** | **Scheme** | **Marks** | **AOs** | **Pearson Progression Step and Progress descriptor** |
| **5a** | (Quantitative) continuous. | **B1** | 1.2 | 1st  Understand the difference between qualitative and quantitative data. |
|  | **(1)** |  |  |
| **5b** | A list of the first two digits of the date. | **B1** | 1.2 | 2nd  Understand the vocabulary of sampling. |
|  | **(1)** |  |  |
| **5c** | Simple random sample | **B1** | 3.1b | 5th  Select and critique a sampling technique in a given context. |
| using a random number generator to select five dates. | **B1** | 1.1b |
|  | **(2)** |  |  |
| **5d** | Number ordered list of data. | **B1** | 3.1b | 3rd  Understand and carry out systematic sampling. |
| Use random number generator is choose first selected piece of data. | **B1** | 3.1b |
| Then take every 6th value | **B1** | 1.1b |
|  | **(3)** |  |  |
| **5e** | Some data may be missing or erroneous. | **B1** | 3.2b | 5th  Select and critique a sampling technique in a given context. |
|  | **(1)** |  |  |
| **(8 marks)** | | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| Q | Scheme | Marks | AOs |
| **6a** | 19.5 + = 26.7093… (Accept awrt **26.7** miles) | **M1**  **A1** | 1.1b  1.1b |
|  | **(2)** |  |
| **6b** | = 29.6041… o.e. (Accept awrt **29.6** miles) | **B1** | 1.1b |
| **  or    or | **M1** | 1.1a |
| *σ* = 16.5515… (Accept awrt **16.6** miles)  (or *s* = 16.6208… = **16.6** miles) | **A1** | 1.1b |
|  | **(3)** |  |
| **6c** | Any sensible reason linked to the shape of the distribution.  For example:  The distribution is (positively) skewed.  A few large distances (values) distort the mean. | **B1** | 2.4 |
|  | **(1)** |  |
| **6d** | Comparison of the two means.  For example, the mean distance for London is smaller than for Devon.  Sensible interpretation comparing a county to a city.  For example, distance to work into one city may not be as far as travelling to different cities in a county.  For example, commuters need to travel further to the cities in Devon for work.  Comparison of the two standard deviations:  For example, the standard deviation for London is larger than for Devon.  Sensible interpretation relating to variability/consistency  For example, there is more variability (less consistency) in the commute distances from the Greater London station than from the Devon station. | **B1**  **B1**  **B1**  **B1** | 1.1b  2.2b  1.1b  2.2b |
|  | **(4)** |  |
| **10 marks** | | | |