G2 *Straight Lines* Activities

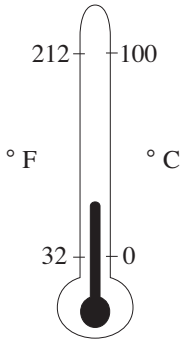
Activities

G2.1 Temperature Conversion
G2.2 Mozart

Notes and Solutions (2 pages)

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ACTIVITY G2.1 *Temperature Conversion*



There are two scales for measuring temperatures in common use in the world:

degrees Fahrenheit (°F), devised by a German physicist, *G D Fahrenheit* (1686–1736),

and

degrees Celsius (°C), devised by a Swedish astronomer, *Anders Celsius* (1701–1744).

The second of these scales was originally known as the 'centigrade' scale, as it uses the $0° - 100°$ range to correspond to the Fahrenheit scale's $32°$ (the temperature at which pure water freezes) to $212°$ (the temperature at which it boils). Temperatures do, of course, exist outside these ranges: for example, temperatures at the polar caps (North and South Poles) *never exceed* $0\,°C$, while the temperature inside a blast furnace is about $1000\,°C$. Although the Celsius scale is now used for most purposes, you will find that the Fahrenheit scale is still also in common usage.

1. On coordinate axes, with °C as the x-axis $(0° \le C° \le 100°)$ and °F as the y-axis $(0° \le F° \le 220°)$, plot the two points (0, 32) and (100, 212). Draw the line that passes through these two points.
2. What is the gradient of this line?
3. What is the intercept of the y-axis?
4. What is the formula for F in terms of C ?
5. Use your graph to estimate the following temperatures in °F:

   (a) 20 °C (b) 25 °C (c) 52 °C

   Check your answers using the formula.
6. Use your graph to estimate the following temperatures in °C:

   (a) 59 °F (b) 75 °F (c) 98.4 °F
7. Rewrite the formula in the form °C = ...

Extension

An approximate formula for converting between °C and °F is given by

$$F = 2C + 24$$

By drawing this graph on the set of axes used for question 1, estimate when it is a reasonable approximation to use. At which point does the approximation become exact?

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ACTIVITY G2.2 *Mozart*



Wolfgang Amadeus Mozart was born in Salzburg, Austria, on 27 January 1756 and died in Vienna on 5 December 1791. He is one of the best known composers in the history of western music.

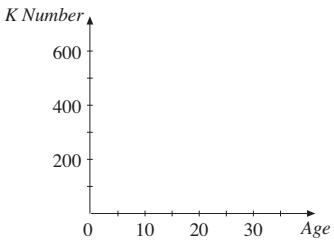
He was a child prodigy and composed a large number of works, using every type of musical composition, and travelling to many countries to perform.

His works were numbered chronologically by a biologist, *Ludwig Ritter von Köchel,* whose catalogue was published in 1862. The following table lists some of Mozart's compositions, each denoted by a 'K' (Köchel) number.

K number	*Date Completed*	*Age* (Years)	*Title*
1	*January 1762*	*6*	*Minuet*
33	*June 1766*	*10*	*Kyrie*
65	*January 1769*		*Dance Music*
123	*April 1770*		*Contredanse*
176	*December 1773*		*Dance Music*
192	*June 1774*		*Missa Brevis (Mass)*
238	*January 1776*		*Piano Concerto No. 6*
271	*January 1777*		*Piano Concerto No. 9*
317	*March 1779*		*Missa (Mass)*
385	*July 1782*		*Symphony No. 35 (Haffner)*
425	*November 1783*		*Symphony No. 36 (Linz)*
470	*April 1785*		*Andante for Strings*
525	*August 1787*		*Serenade (Eine Kleine Nachtmusik)*
551	*August 1788*		*Symphony No. 41 (Jupiter)*
588	*January 1790*		*Opera (Cosi fan tutte)*
620	*September 1791*		*Opera (Die Zauberflote - The Magic Flute)*
626	*December 1791*		*Requiem*

1. Copy and complete the 'Age' column.

2. Plot the data of age (*x*-axis) against K number (*y*-axis), and by eye, draw a line of best fit.



3. Use the graph to estimate Mozart's age when he completed the piano concertos: (a) K453, (b) K491.

4. Estimate how many compositions he had completed by the time he was 30 years old.

5. Estimate the K number for his quartet which was finished on Christmas Day, 1777.

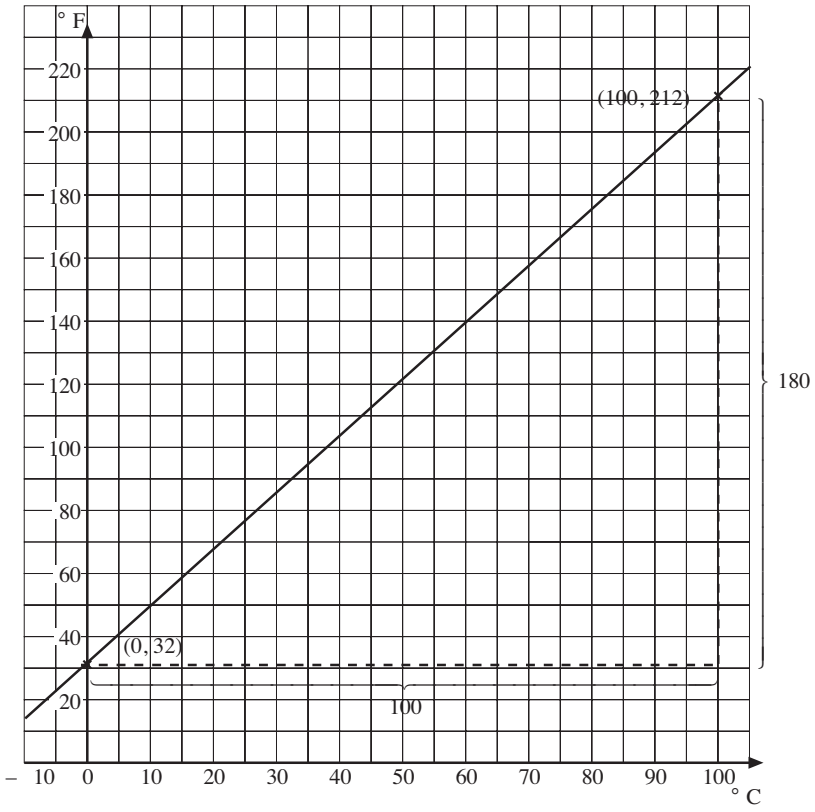
6. Find the equation of your line in question 2, in the form $y = mx + c$, i.e. K = $m \times$ age + c. Use the equation to answer question 3 and 5 again. Does it give accurate answers?

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ACTIVITY G2.1 *Notes and Solutions*

Notes and solutions given only where appropriate.

G2.1



2. $\dfrac{180}{100} = \dfrac{9}{5}$

3. 32

4. $F = \dfrac{9}{5}C + 32$

5. (a) 68 °F (b) 77 °F (c) About 126 °F

6. (a) 15 °C (b) About 24 °C (c) 36.9 °C

7. $°C = \dfrac{5}{9}(°F - 32)$

Extension

Approximation is exact when $2C + 24 = \dfrac{9}{5}C + 32$, which gives $C = 40$.

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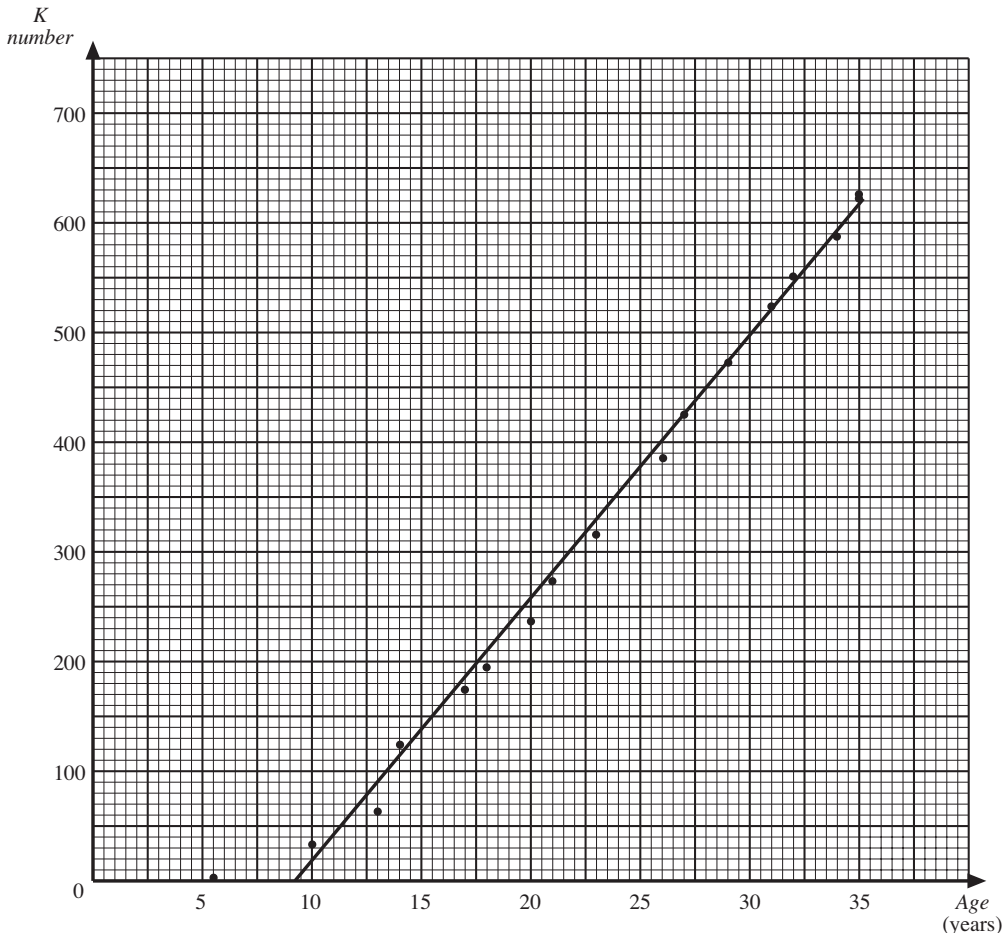
ACTIVITY G2.2 *Notes and Solutions*

G2.2.

1.

Age Column
6
10
13
14
17
18
20
21
23
26
27
29
31
32
34
35
35

2. Graph



3. (a) About 28 years (b) About 30 years

4. About 480

5. About K291 $\left(\frac{12}{27} \times 46 + 271\right)$

6. Approximately $K = 24 \times \text{age} - 240$

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