1. **(C5.4 - N)** **(CI)** Determine the equations of the lines that are *tangent* and *normal* to the following functions at the specified points. (Reminder: a ***normal line*** is perpendicular to a ***tangent line***)
   (Cirrito 20.1, p.646)
   a. $y = x(x-3)^2$ at the point where $x = 1$.
   b. $y = x^3 + x^2$ at the point where $x = -\frac{2}{3}$.
   c. $y = 2x + \frac{1}{x}$ at the point where $x = \frac{1}{2}$.

2. **(C5.4 - N)** **(CI)** The function $y = ax^3 - 2x^2 - x + 7$ has a slope of 3 at the point where $x = 2$. Find the value of a.
   (Cirrito 20.1, p.646)

3. **(C5.7 - N)** **(CI)** Here is a graph of a function. Sketch graphs of the *first* and *second* derivatives of this function.
   (Cirrito 19.2, p.609)
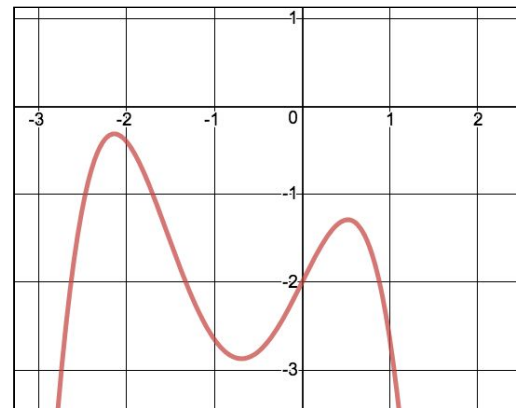
4. **(C5.4 - N)** **(CI)** For $f(x) = 2x^3 + 3x^2 - 72x + 5$ determine:
   (Cirrito 20.2, p.649)
   a. the equation of the derivative of $f(x)$.
   b. the zeroes of $f'(x)$.
   c. Hence or otherwise, find the coordinates of the stationary points of f.
   d. Hence or otherwise, find the intervals of increase and decrease of f.
   e. Sketch a graph of f. Then use your calculator and graph f and compare.

5. **(C5.4 - N)** **(CI)** For the function $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$ determine:
   (Cirrito 20.2, p.649)
   a. the equation of the second derivative of $f(x)$.
   b. the zeroes of $f''(x)$.
   c. Hence or otherwise, find the coordinates of the inflection points of f.
   d. Hence or otherwise, find the intervals of concavity of f.
   e. Sketch a graph of f. Then use your calculator and graph f and then compare.

6. **(SP4.3 - R) (CA)** Here are the results of last year's IB scores from the 2018 graduating class from Juan Fine High School:

   (Oxford 8.3, p.260)

Score	1	2	3	4	5	6	7
Number of students	0	2	2	8	12	6	1

   a. Explain why this example illustrates a discrete data set.
   b. (CI) Set up a calculation in order to determine the average score from these students.
   c. Determine the mean, median, variance and standard deviation of the scores.
   d. How probable is it that a randomly chosen student from this class scored 5 or more?
   e. Draw a frequency histogram for this distribution.

7. **(SP4.7 - E) (CA)** Here is a probability distribution of a discrete random variable (say the number of students and their AP scores in the AP US History course):

   (Oxford 15.1, p.520)

X *(score)*	0	1	2	3	4	5
$P(X = x)$	0.08	0.40	0.24	0.15	0.08	0.05

   a. Use the equation $E(X) = \Sigma x P(x)$ to determine the expected value of the scores.
   b. Use the equation $var(X) = \sigma^2 = \Sigma(x - \mu)^2 P(x)$ to determine the variance and hence the standard deviation of the scores.
   c. Use your calculator and lists to perform the same calculations.
   d. Draw a frequency histogram for this distribution.

8. **(SP4.7 - E) (CA)** The discrete random variable X has a probability density function defined by the rule $P(X = x) = k(25 - x^2)$, for $x \in \{1, 2, 3, 4, 5\}$.

   (Oxford 15.1, p.520)

   a. Create a probability distribution table and hence find the value of k.
   b. Find $E(X)$ and $var(X)$.
   c. Find $P(1 < x \le 3)$.
   d. Find $P(x = 3 \mid x \ge 2)$.