

**S6MA3ENA – Semestre 1**

**MATHEMATICS 3**

**Part A**

**Date:** Wednesday 15th December 2021

**DURATION OF EXAMINATION:**

1 hour 30 minutes (90 minutes)

**Answer ALL questions**





K. Osborne

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| **PART A** | **Marks** |
| 1. Give the derivative $f'(x)$ of the following functions:
2. $f\left(x\right)=x^{3}-3x^{2}$
3. $f\left(x\right)=2x^{2}+x-3$
4. $f\left(x\right)=\frac{1}{2}x-\frac{1}{3}x^{3}+\frac{2}{3}x^{6}$
5. Consider the graph of the function $ f$ shown below.

The line r is a tangent line to the graph of $ f$ at point A.(a) Use the information in the diagram to find the equation of the line r.(b) Given that $f\left(x\right)=x^{3}-3x^{2}+2x+1$, use the diagram or otherwise to find the value of $f^{'}\left(0\right)$. 1. A town`s population is growing linearly. In 2018 the population was 5000. By 2020 the population had increased to 7400.
2. Give the function $P(t)$ where $P$ is the population and $t$ is the number of years since 2018.
3. Use your function$ P(t)$ to predict the population in 2025.

 1. According to this model in which year will the population reach 19400?
2. The function $f$ is defined as $f\left(x\right)=2x^{2}-8x+8$.
3. Determine the coordinates of the y-intercept.
4. Calculate $f\left(2\right)$
5. Determine the derivative$ f^{'}\left(x\right)$.
6. For what value of $x$ does the function $f\left(x\right)$ have a turning point? State the nature of the turning point and explain your answer.
7. Find the equation of the tangent to the curve at the point (1,2).
8. The point A is a point on the graph of $f$. The gradient at the point A is equal to 12. Find the coordinates of the point A.
9. The diagram below shows the graph of the function $f\left(x\right)=\frac{ax+b}{x+c}$.

The dotted blue lines represent the asymptotes. The graph passes through the point $\left(0,-\frac{1}{2}\right)$.1. Give the equation of the vertical asymptote.
2. State the domain of the function.
3. Find value of $c$.
4. Give the equation of the horizontal asymptote.
5. State the range of the function.
6. Find value of $a$.
7. A student says that the value of $b$ is 1. Are they correct? You must justify your answer.

1. The graph of the derivative $f^{'}\left(x\right)$ is given below.

1. Give the $x$-coordinates of the two turning points.
2. For which values of $x$ is the graph of $f\left(x\right)$ increasing?
3. For which value of $x$ does $f(x)$ reach a minimum?
4. Sketch a possible graph of $f\left(x\right)$ , given that the point $\left(8,0\right)$ lies on the graph of$ f(x)$.
5. The graph below is the graph of the function $f\left(x\right).$

Which of the 4 graphs below is the corresponding graph of $f^{'}\left(x\right)$?For each graph you **must** explain why it is or is not the correct graph.BADC | 22244322222344222222222234 |