First Name: _____ Last Name: _____

Student-No: _____ Section: _____

Very short answer questions

1. 2 marks Each part is worth 1 marks. Please write your answers in the boxes.

   Consider a function, $h(x)$, whose third-degree Maclaurin polynomial is $1 - 3x + \frac{1}{6}x^2 + \frac{2}{7}x^3$.

   (a) What is $h'(0)$?

   Answer:

   (b) What is $h''(0)$?

   Answer:

Short answer questions — you must show your work

2. 4 marks Each part is worth 2 marks.

   (a) Estimate $\sqrt[4]{15}$ using a linear approximation

   (b) Consider a function $f(x)$ which has $f^{(3)}(x) = \dfrac{x}{10 - \sin x}$. Show that when we approximate $f(1)$ using its second degree Maclaurin polynomial, the absolute value of the error is less than $\frac{1}{50} = 0.02$.

Long answer question — you must show your work

3. [4 marks] Two particles move in the cartesian plane. Particle A starts at $(3, 0)$ while particle B starts at $(0, 0)$. Particle A moves in the $+y$ direction at 1 unit per second, while B moves in the $-y$ direction at 3 units per second. How fast is the distance between the particles changing when the distance between them is 5 units?

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Very short answer questions

1. 2 marks Each part is worth 1 marks. Please write your answers in the boxes.

   Consider a function, $h(x)$, whose third-degree Maclaurin polynomial is $5 - \frac{1}{3}x^2 + 2x^3$.

   (a) What is $h'(0)$?

   Answer:

   (b) What is $h''(0)$?

   Answer:

Short answer questions — you must show your work

2. 4 marks Each part is worth 2 marks.

   (a) Estimate $\sqrt{35}$ using a linear approximation

   (b) Consider a function $f(x)$ which has $f^{(3)}(x) = \dfrac{x^3}{10 - x^2}$. Show that when we approximate $f(1)$ using its second degree Maclaurin polynomial, the absolute value of the error is less than $\frac{1}{50} = 0.02$.

Long answer question — you must show your work

3. [4 marks] Two particles move in the cartesian plane. Particle A travels on the x-axis starting at $(10, 0)$ and moving towards the origin with a speed of 2 units per second. Particle B travels on the y-axis starting at $(0, 12)$ and moving towards the origin with a speed of 3 units per second. What is the rate of change of the distance between the two particles when particle A reaches the point $(4, 0)$?

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Very short answer questions

1. 2 marks Each part is worth 1 marks. Please write your answers in the boxes.
   Consider a function, $f(x)$, whose third-degree Maclaurin polynomial is $4 + 3x^2 + \frac{1}{2}x^3$.
   (a) What is $f'(0)$?

   Answer:

   (b) What is $f''(0)$?

   Answer:

Short answer questions — you must show your work

2. 4 marks Each part is worth 2 marks.
   (a) Estimate $\sqrt[3]{9}$ using a linear approximation

   (b) Consider a function $f(x)$ which has $f^{(3)}(x) = \frac{1}{5}e^{-2x} \cdot \sin(x)$. Show that when we approximate $f(1)$ using its second degree Maclaurin polynomial, the absolute value of the error is less than $\frac{1}{30}$.

Long answer question — you must show your work

3. [4 marks] Two particles move in the Cartesian plane. Particle A starts at $(2, 0)$ and moves on the x-axis away from the origin at 1 unit per second. Particle B starts at the origin, and moves along the y-axis at 2 units per second (in the $+y$-direction). How fast is the distance between the particles increasing when A reaches $(6, 0)$?

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Very short answer questions

1. 2 marks Each part is worth 1 marks. Please write your answers in the boxes.

   Consider a function, $h(x)$, whose third-degree Maclaurin polynomial is $1 + 4x - \frac{1}{3}x^2 + \frac{3}{4}x^3$.

   (a) What is $h^{(3)}(0)$?

   Answer:

   (b) What is $h''(0)$?

   Answer:

Short answer questions — you must show your work

2. 4 marks Each part is worth 2 marks.

   (a) Estimate $\sqrt[3]{26}$ using a linear approximation.

   (b) Consider a function $f(x)$ which has $f^{(3)}(x) = \dfrac{e^{-x}}{8 + x^2}$. Show that when we approximate $f(1)$ using its second degree Maclaurin polynomial, the absolute value of the error is less than $1/40$.

Long answer question — you must show your work

Two particles move in the cartesian plane. Particle A travels on the x-axis starting at $(10, 0)$ and moving towards the origin with a speed of 2 units per second. Particle B travels on the y-axis starting at $(0, 2)$ and moving away from the origin with a speed of 4 units per second. What is the rate of change of the distance between the two particles when particle A reaches the point $(5, 0)$?