MATH 102-101 Quiz 4 - Individual stage

Name: _____

Student number:

⓪	⓪	⓪	⓪	⓪	⓪	⓪	⓪
①	①	①	①	①	①	①	①
②	②	②	②	②	②	②	②
③	③	③	③	③	③	③	③
④	④	④	④	④	④	④	④
⑤	⑤	⑤	⑤	⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥	⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦	⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧	⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨	⑨	⑨	⑨	⑨

For instructor use only.

Question:	Mark:
1a	⓪ ① ② ③ ④ ⑤
1b	⓪ ① ② ③ ④ ⑤
1c	⓪ ① ② ③ ④ ⑤
2	⓪ ① ② ③ ④ ⑤

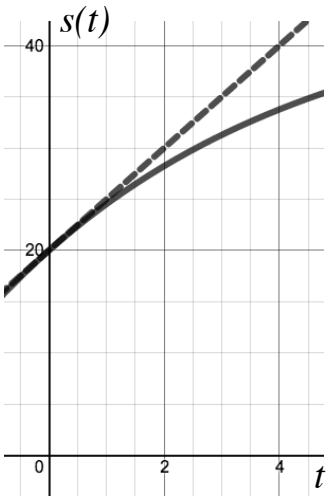
Quiz 4 - Individual stage

1. Snow accumulates on the roof of your house during a snow storm at a rate of 9 cm/hr. Because pressure decreases the melting point of ice, the rate at which the snow melts from the roof is proportional to the depth of snow on the roof with constant of proportionality p.

   (a) [2 pts] Write down a differential equation for the depth of snow on your roof $s(t)$.

   (b) [1 pt] What is the steady state depth of the snow (in terms of p)?

   (c) [3 pts] You measure the depth of the snow throughout the storm and plot it. Use the graph to determine the value of the constant p. The solid curve is $s(t)$ and the dashed line is the tangent line to $s(t)$ at $t = 0$. Recall the solution in the general case: $y(t) = \frac{a}{b} + (y_0 - \frac{a}{b})e^{-bt}$.



2. [4 pts] Calculate six steps of Euler's method with a step size of $\Delta t = 1$ for the function $y(x)$ which satisfies the equations $y' = -2y$ and $y(0) = 3$. Does this give a good approximation of $y(x)$? Explain.

MATH 102-101 Quiz 4 - Group stage

Name: ____________________

Student number:

0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

Name: ____________________

Student number:

0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

Name: ____________________

Student number:

0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

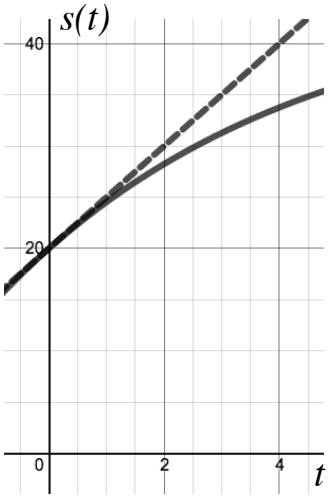
For instructor use only.

Question:	Mark:					
1	0	1	2	3	4	5
2	0	1	2	3	4	5
3	0	1	2	3	4	5

Quiz 4 - Group stage

1. Snow accumulates on the roof of your house during a snow storm at a rate of 9 cm/hr. Because pressure decreases the melting point of ice, the rate at which the snow melts from the roof is proportional to the depth of snow on the roof with constant of proportionality p.

   (a) [3 pts] You measure the depth of the snow throughout the storm and plot it. Use the graph to determine the value of the constant p. The solid curve is $s(t)$ and the dashed line is the tangent line to $s(t)$ at $t = 0$. Recall the solution in the general case: $y(t) = \frac{a}{b} + (y_0 - \frac{a}{b})e^{-bt}$.



2. [1 pts] Under what conditions will Euler's method underestimate the exact solution?

   (a) When the derivative of the exact solution is positive.

   (b) When the derivative of the exact solution is negative.

   (c) When the second derivative of the exact solution is positive.

   (d) When the second derivative of the exact solution is negative.

3. [2 pts] When using Euler's method with a step size of $\Delta t = 1$ for the function $y(x)$ which satisfies the equations $y' = -2y$ and $y(0) = 3$, do the calculated values underestimate or overestimate the exact solution. Explain with reference to the previous question.