Answer sheet (To be handed in)

Week 7 Coursework Test (2018) | ***MATH10222/11222*** **Calculus and Applications**

You Should Try to Answer All Questions

- ***Mark with an 'X' only one box corresponding to the correct answer to each of the questions on the question sheet.***
- ***Important:** negative marking will be used for incorrect answers. You are free not to give an answer if you wish.*
- ***The table below indicates the marks awarded for a [r]ight, [w]rong and [n]o answer for each question.***
- ***The highest possible total mark is 23 — the lowest mark is zero.***
- ***A total mark of 23 counts as 100% for the test.***
- ***This document has 8 pages.***

Full name:

Student identity number:

Name of supervisor:

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											[r][w][n]
1.	(a)	X	(b)								[1][-1][0]
2.	(a)		(b)	X	(c)						[2][-1][0]
3.	(a)		(b)		(c)	X	(d)				[3][-1][0]
4.	(a)		(b)	X							[1][-1][0]
5.	(a)		(b)	X							[1][-1][0]
6.	(a)		(b)		(c)		(d)	X	(e)		[8][-2][0]
7.	(a)		(b)		(c)	X	(d)		(e)		[4][-1][0]
8.	(a)		(b)		(c)		(d)	X			[3][-1][0]

At the end of the test please separate this answer sheet from the question sheets and hand it in.

Question sheet (Not to be handed in)

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1. The initial value problem comprising the ODE [1]

$$\frac{dy}{dx} = \frac{x^2 - 2}{y}$$

with initial condition $y(x = X) = Y$ where X and Y are given constants, is guaranteed to have a unique solution for all values of x.

(a) $\Longrightarrow$false

(b) true

2. The initial value problem comprising the ODE [2]

$$y'' + \frac{1}{x}\, y' - \frac{4}{x^2}\, y = 0$$

with initial conditions $y(x = 1) = 1$ and $y'(x = 1) = 2$

(a) is guaranteed to have a unique solution for $x \in \mathbb{R}$ because the ODE is linear.

(b) $\Longrightarrow$is guaranteed to have a unique solution for $x > 0$.

(c) can only have a solution for $x > 0$ because the coefficients $1/x$ and $4/x^2$ are singular at $x = 0$.

3. The integrating factor for the first-order ODE [3]

$$\frac{dy}{dx} - 3x^2 = -\frac{y}{x}$$

is

(a) $\int \exp(-3x^2)\, dx$

(b) $\exp(-\int 3x^2\, dx)$

(c) $\Longrightarrow$$\exp(\int \frac{1}{x}\, dx)$

(d) $\int \exp(\frac{1}{x})\, dx$

4. The functions $y_1(x) = \exp(x)$ and $y_2(x) = \exp(a + x)$ where a is a constant are linearly independent provided $a \neq 0$. [1]

   (a) true

   (b) $\Longrightarrow$false

5. The *general* solution to the homogeneous ODE [1]

$$xy'' + y\ y' = 0$$

   is given by $y(x) = Ay_1(x) + By_2(x)$ where A and B are arbitrary constants and $y_1(x)$ and $y_2(x)$ are *any* two nonzero, linearly independent solutions of the ODE.

   (a) true

   (b) $\Longrightarrow$false

6. The general solution of the ODE [8]

$$y'' - 3y' + 2y = 1 + \exp(2x)$$

is given by

(a) $y(x) = \exp(2x)(A\cos(x) + B\sin(x)) + \frac{1}{2} + x\exp(2x)$

(b) $y(x) = A\exp(-2x) + B\exp(-x) + 1 + x\exp(2x)$

(c) $y(x) = A\exp(2x) + B\exp(x) + 1 + \exp(2x)$

(d) $\Longrightarrow y(x) = A\exp(2x) + B\exp(x) + \frac{1}{2} + x\exp(2x)$

(e) $y(x) = A\exp(-2x) + B\exp(-x) + \frac{1}{2} + x\exp(2x)$

where A and B are arbitrary constants.

7. The general solution of the ODE [4]

$$x\frac{dy}{dx} = x + y$$

is given by

(a) $y(x) = x \ln |x| + C$

(b) $y(x) = x \ln |x| + x + C$

(c) $\Longrightarrow y(x) = x \ln |x| + Cx$

(d) $y(x) = C \ln |x| + x$

(e) $y(x) = Cx \ln |x| + x$

where C is an arbitrary constant.

8. The solution of the initial value problem [3]

$$\frac{dy}{dx} = \frac{1}{2y}\exp(x - y^2), \quad y(0) = 1$$

is given by

(a) $y(x) = (\ln(\exp(x) + 1))^{1/2}$

(b) $y(x) = -(\ln(\exp(x) + \exp(1) - 1))^{1/2} + 2$

(c) $y(x) = (x + 1)^{1/2}$

(d) $\Longrightarrow y(x) = (\ln(\exp(x) + \exp(1) - 1))^{1/2}$

End of test

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