WESLEY COLLEGE
By daring & by doing

YEAR 12 MATHEMATICS METHODS

SEMESTER ONE 2018

TEST 4: ANTIDIFFERENTIATION, APPLICATIONS OF CALCULUS AND FUNDAMENTAL THEOREM OF CALCULUS

Thursday 24 May Name: _____

Time: 45 minutes **Part A:** ___/27 **Part B:** ___/16 **Total:** ___/43 **%**

- Answer all questions neatly in the spaces provided. **Show all working.**
- You are permitted to use the Formula Sheet for both sections, and an A4 page of notes, plus up to 3 permitted calculators in the Calculator Allowed section.

Calculator Free

1. [6 marks]

Determine the anti-derivative of

a) $(4-3x)^2$

[2]

b) $5x^4 - \frac{9}{\sqrt{x}}$

[2]

c) $\frac{10x}{x^2+5}$

[2]

2. [4 marks]

Determine the following, simplyfying your answers:

a) $\int \frac{1-x^3}{x^2}\,dx$

[2]

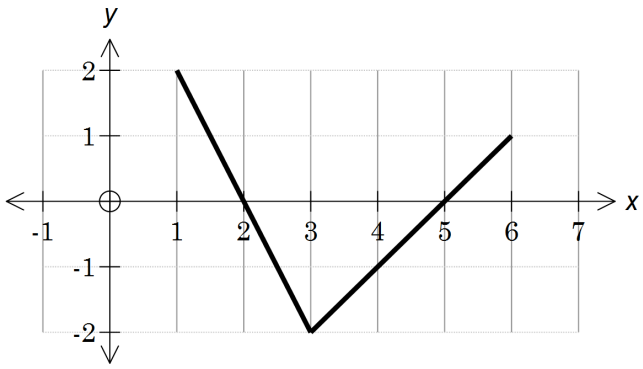
b) $\frac{d}{dx}\left(\int_x^7 \frac{2t}{t^2-5}\,dt\right)$

[2]

3. [3 marks]

Let the graph of $f(x)$ between $x = 1$ and $x = 6$ be as shown.

Evaluate $\int_1^6 f(x)\,dx$.



[3]

4. [7 marks]

A particle *P* moves in a straight horizontal line such that its acceleration at time *t* seconds is given by $a = k(2t - 5)$, where k is a positive constant.

Given that at time $t = 0$, *P* is at rest at the origin and that at time $t = 6$, its velocity is $1.5\ ms^{-1}$,

a) find the acceleration of *P* in terms of *t*.

[4]

b) show that the displacement of the particle, *x* metres, from *O* at time *t* is given by

$$x = \frac{1}{24}t^2(2t - 15)$$

[3]

5. [4 marks]

Use $\int_{-2}^{4} f(x)\,dx = 8$ and $\int_{-2}^{1} f(x)\,dx = 1$ to evaluate the following:

a) $\int_{-2}^{4} -5f(x)\,dx$

[1]

b) $\int_{1}^{4} f(x)\,dx$

[1]

c) $\int_{-2}^{4} [f(x) - 2x]\,dx$

[2]

6. [3 marks]

The rate of flow of a liquid into a container is given by $\frac{dV}{dt} = e^{0.5t}$, where *V* is the volume in cubic centimetres and *t* is the time in seconds.

Find the volume of liquid in the container after 3 seconds if the container intially holds 10 cm^3.

[3]

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(16 marks)

Resourced

7. [5 marks]

a) Find $\frac{dy}{dx}$ given $y = x.\sin x$

[2]

b) Use your answer to part (a) to find $\int (x.\cos x)dx$

[3]

8. [6 marks]

The velocity of a body moving along a straight line is given by $v = -3t^2 - 2t + 5$ m/s where t is the time in seconds. The initial displacement of the body from a fixed point *O* is 3 metres.

a) Find the displacement of the body when $t = 5$.

[2]

b) Find the instantaneous speed at $t = 5$ seconds

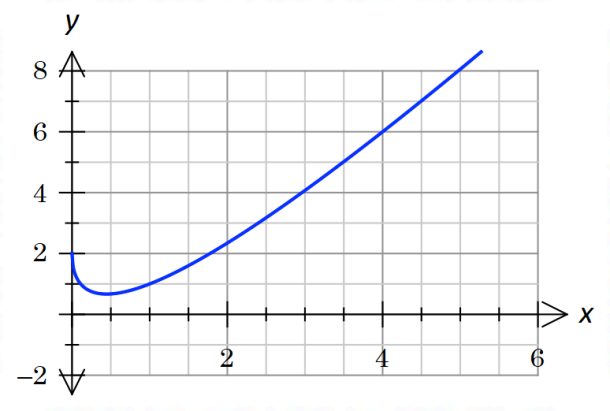
[1]

c) What is the average speed of the body over the first 5 seconds?

[3]

9. [5 marks]

A sketch of the curve *C* with equation $y = 3x - 4\sqrt{x} + 2$ has been given below.



a) Using the tanLine command, or otherwise, determine the equation of the tangent, which has *x*-coordinate 4.
Draw the tangent on the sketch.

[2]

b) Write down the integral(s) that will determine the area of the region captured by *C*, the tangent to *C* at *A* and the positive coordinate axes and state the area.

[3]