



**APPLECROSS**  
SENIOR HIGH SCHOOL

STUDENT NAME: \_\_\_\_\_

All working must be shown in the space provided. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than 1 mark, valid working or justification is required to receive full marks.

	Total	Result	%
Section 1	20		
Section 2	54.8		
Total	74.8		

**Section 1: Resource – Free**

Working time: 15 minutes  
20

**Question 1** [2 marks]

Find  $y$  if  $\frac{dy}{dx} = 3x^2 + x + 3$  and  $y = 0$  when  $x = 1$ .

**Question 2** [2 marks]

Determine  $\int \sqrt[3]{4x+3} dx$

**Question 3** [2 marks]

Find the antiderivative of  $\frac{1}{(2x-1)^3}$  with respect to  $x$ .

**Question 4** [2, 2, 2 = 6 marks]

Find

a)  $\int \frac{5}{2}(\sqrt{x}-1)^2 dx$

b)  $\int 5x^2(3+2x^3)^4 dx$

**Question 4** [2, 2, 2 = 6 marks]

Find

a)  $\int \frac{5}{2}(\sqrt{x} - 1)^2 dx$

b)  $\int 5x^2(3 + 2x^3)^4 dx$

c)  $\int \frac{x-x^3}{(3-2x^2+x^4)^5} dx$

**Question 5** [3 marks]

Find the derivative of  $F(x)$  given that  $F(x) = \int_1^{x^2+3}(2t - 1)dt$

**Question 6** [2, 3, 3 = 8 marks]

Determine these definite integrals:

a)  $\int_{-1}^1 (x + 1)(x - 2)dx$

b)  $\int_1^2 \left(\frac{x+1}{x^3}\right) dx$

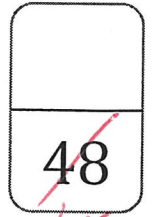
c)  $\int_{-1}^0 \sqrt{1+x} dx$

**END OF SECTION 1**



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**Section 2: Resource – Rich**  
**Working time: 38 minutes**

**To be provided by the student:**  
ClassPad and/or Scientific Calculators  
1 sheet of A4-sized paper of notes, double-sided

**Question 1** [2, 2, 2, 2 = 8 marks]

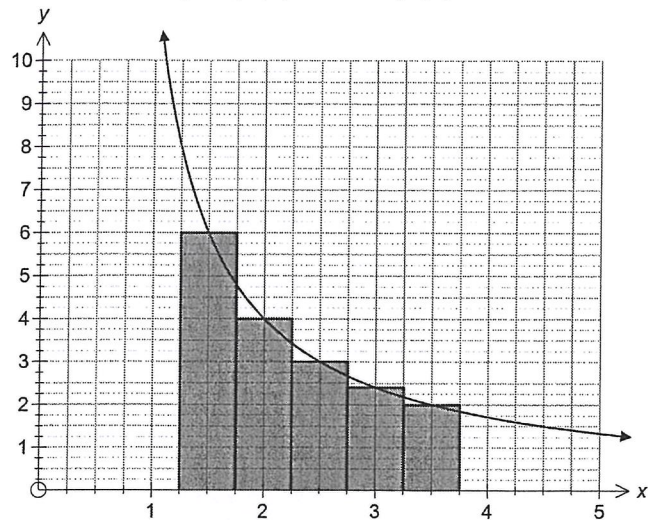
The velocity  $v(t)$  in  $m/s$  of a particle travelling in a straight line is given by

$$v(t) = t^2 - 6t + 5$$

- Determine the distance travelled in the 4<sup>th</sup> second.
- Determine the distance travelled in the interval  $1 \leq t \leq 5$ .
- If initially the particle has a displacement of  $-10m$ , what is the displacement when  $t = 3$ .
- Calculate the acceleration when  $t = 2$ .

**Question 2** [3 marks]

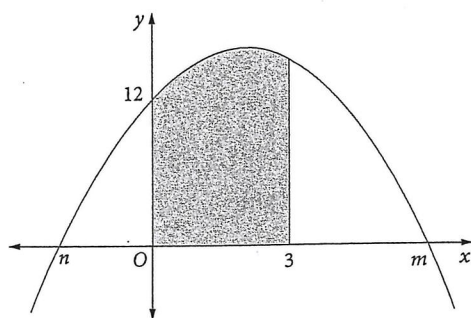
The graph below shows the curve  $y = f(x)$ , where  $f(3) = 2.4$ .



Use three of the five centred rectangles shown to estimate the shaded area under the curve from  $x = 1.75$  to  $x = 3.25$ .

**Question 3** [5 marks]

Part of the graph of  $f(x) = -x^2 + ax + 12$  is shown below:



If the area of the shaded section is 45 square units, determine the values of  $a$ ,  $m$  and  $n$ , where  $m$  and  $n$  are the  $x$  intercepts of the graph of  $y = f(x)$ .

**Question 4** [2, 3= 5 marks]

The instantaneous rate with which the concentration  $C$ , in mg/KL, of a chemical compound in a river system changes with respect to time,  $t$  weeks, is modelled by the equation

$$\frac{dC}{dt} = \frac{1}{(t + 0.5)^2} - 2t, \quad \text{for } t \geq 0$$

The initial concentration was 9.3 mg/KL.

a) Determine the net change in concentration in the first week.

b) Find the maximum concentration and when this occurred.

**Question 5** [2, 2 = 4 marks]

Given that  $f(x)$  is continuous everywhere and that  $\int_{-4}^6 f(x) dx = 10$ , find

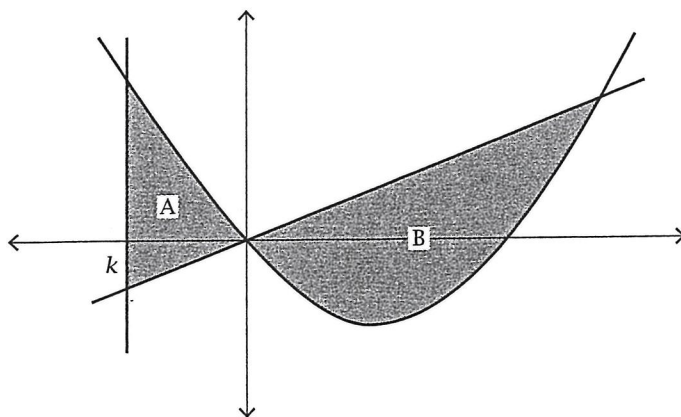
a)  $\int_{-4}^6 (2x - 2f(x)) dx$

b)  $\int_{-2}^8 3f(x - 2) dx$

**Question 6** [3, 2, 3 = 8 marks]

The graph below consists of the following functions:

$$y = x^2 - 2x, \quad y = \frac{1}{2}x, \quad y = k \quad \text{where } k \text{ is a constant}$$



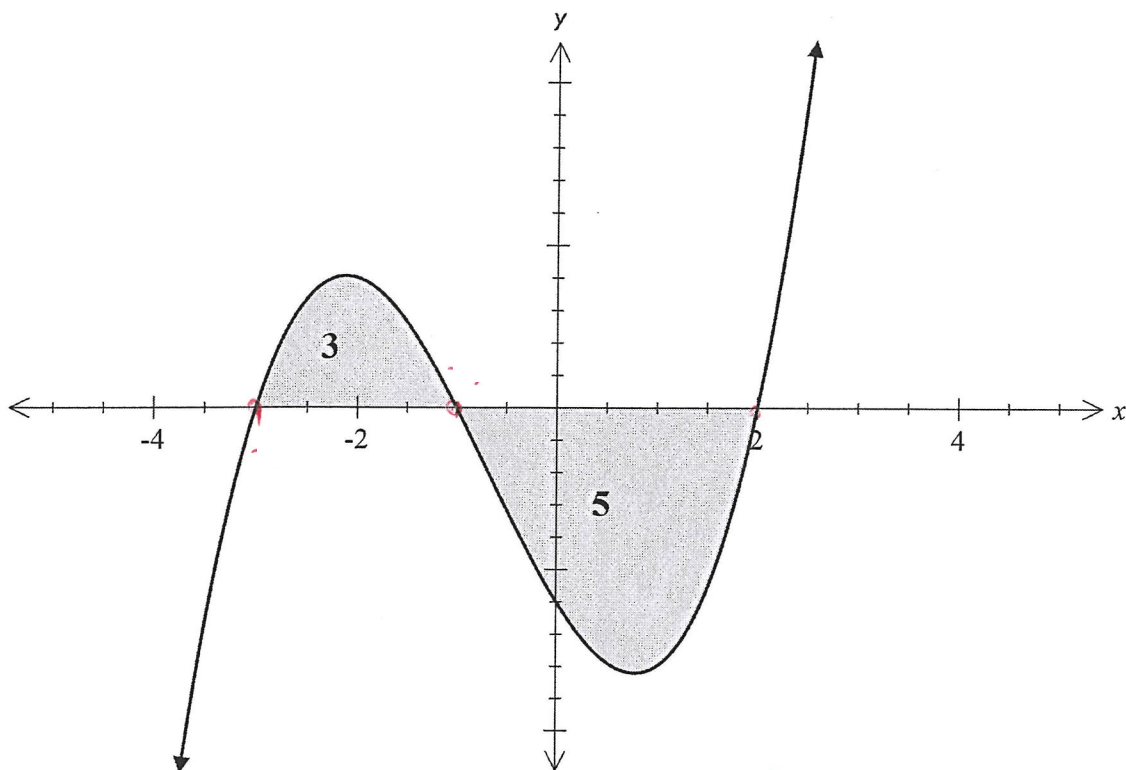
a) State an integral which represents the area of region B and calculate the area.

b) State an integral which represents the area of region A.

c) Find the value of  $k$  for which the area of region A equals the area of region B.

**Question 7** [1, 1, 1, 1, = 4 marks]

Use the graph below to determine the following definite integrals. The area of the curve containing A is 3 square units and the area of the curve containing B is 5 square units.



a)  $\int_{-3}^2 f(x) dx$

b)  $\int_1^{-2} f(-x) dx$

c)  $\int_{-3}^2 -f(x) dx$

d)  $\int_{-3}^{-1} [f(x) + 3] dx$

**Question 8** [4 marks]

Find  $\int_0^4 \frac{d}{dx} \left( \frac{1-\sqrt{x}}{1+\sqrt{x}} \right) dx$

**Question 9** [4 marks]

Find the  $x$  coordinate(s) of the stationary point(s) of the curve given by  $y = \int_1^{x+1} t^2(t-2) dt$