c) State the natural domain and range of the function graphed in part (b)

$D: \{x : x \in \mathbb{R}, x \neq 0\}$ ✓

$R: \{y : y \in \mathbb{R}, y \neq 1\}$ ✓

d) For the function $w(x) = \frac{3}{4-x} + 2$, determine the

i) equation of any and all asymptotes

Horizontal: $w(x) = 2$ ✓

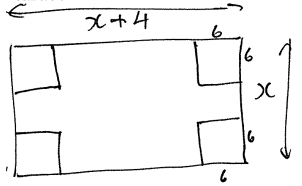
Vertical: $x = 4$ ✓

ii) behaviour of $w(x)$ as $x \to +\infty$

as $x \to +\infty$, $w(x) \to 2$

Question 11 [4 marks]

A rectangular piece of cardboard is 4 cm longer than it is wide. An open-top box is constructed from the piece of cardboard by cutting a 6 cm square out of each corner and folding the resulting flaps upwards to create the box. If the volume of the box created in this way is 840 cm^3, find the dimensions of the original piece of cardboard.



$V = \ell \times b \times h = 840$

$\Rightarrow (x+4-12)(x-12) \times 6 = 840$ ✓✓

$(x-8)(x-12) \times 6 = 840$

$\Rightarrow$ CP $\Rightarrow x = -2$ or 22 ✓*

reject

$\Rightarrow$ Dimensions are 22×26 cm ✓

(* OR $(x-8)(x-12) = 140$

$x^2 - 20x + 96 = 140$

$x^2 - 20x - 44 = 0$

$(x+2)(x-22) = 0$)

END OF TEST

YEAR 11 MATHEMATICS METHODS UNIT 1

TEST 3
TERM 2, 2018
Test date: Wed 9th of May

APPLECROSS
SENIOR HIGH SCHOOL

STUDENT NAME: Solution

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 2 marks, valid working or justification is required to receive full marks.

	Total	Result	
Section 1	33		%
Section 2	25		
Total	58		

Section 1: Resource – Free

Working time: 33 minutes

Question 1 [1, 1 = 2 marks]

For the graph of $y = (x+3)^2 - 2$ state:

a) The coordinates of the y-intercept

$x = 0 \Rightarrow y = 7$ $(0, 7)$ ✓

b) The equation of the line of symmetry

$x = -3$ ✓

Question 2 [1, 1 = 2 marks]

For the graph of $y = (x+4)(x-2)$ state:

a) The equation of the line of symmetry

$\frac{-4+2}{2} = -1$ $x = -1$ ✓

b) The coordinates of the turning point

$y = (-1+4)(-1-2) = -9$

$(-1, -9)$ ✓

Question 3 [3 marks]

On the axes shown right, sketch a graph of the function

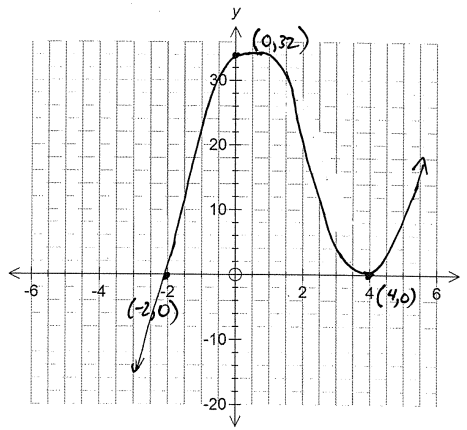
$y = (x+2)(x-4)^2$

Clearly label all axes intercepts.

roots at -2 & 4 ✓

y-int at 32 ✓

Shape/ orientation ✓



Question 4 [3, 2, 2 = 7 marks]

Given $g(x) = 3x^3 - 16x^2 + 23x - 6 = (x-2)(ax^2 + bx + c)$;

a) Find the values of a, b, and c.

$a = 3$ ✓

$c = 3$ ✓

$-6x^2 + bx^2 = -16x^2$

$\Rightarrow \quad b = -10$ ✓

b) Hence, fully factorise $g(x)$.

$(x-2)(3x^2 - 10x + 3)$

$= (x-2)(3x - 1)(x - 3)$ ✓ ✓

c) Solve the equation $3x^3 - 16x^2 + 23x - 6 = 0$.

$x = 2, +\frac{1}{3}$ or 3 (-1 each error/omission)

Question 5 [4, 2, 2 = 8 marks]

a) Graph the function $y = x^2 - 4x - 7$ on the axes on the next page below over the range $-2 \le x \le 5$, labelling and stating the:

i) line of symmetry,
ii) turning point,
iii) y-intercept.

i) $-\frac{b}{2a} = \frac{4}{2} = 2$ ü $x = 2$ LOS.

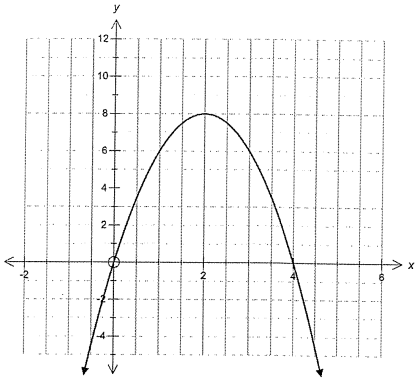
ii) TP at $y = 2^2 - 4\times2 - 7 = -11$ TP = $(2, -11)$

iii) $y(0) = -7$

(also $y(-2) = 5$, $y(5) = -2$

Question 9 [3 marks]

Derive the equation of the function graphed on the right.



T.P @ $(2, 8)$

$\Rightarrow y = a(x-2)^2 + 8$ ✓

Sub $(0,0)$:

$0 = a(0-2)^2 + 8$

$\Rightarrow \quad 0 = 4a + 8$

$\Rightarrow \quad a = -2$ ✓

ü $\quad y = -2(x-2)^2 + 8$ ✓

Question 10 [2, 2, 2, 2, 1 = 9 marks]

a) Under certain circumstances, the volume V (in mL) of a given quantity of gas is inversely proportional to its pressure P (in kPa). In a particular experiment, when the pressure was 90 kPa, the volume of gas was 40 mL. What will the volume be when the pressure is increased to 120 kPa?

$V = \frac{k}{P}$

$P = 90, V = 40$

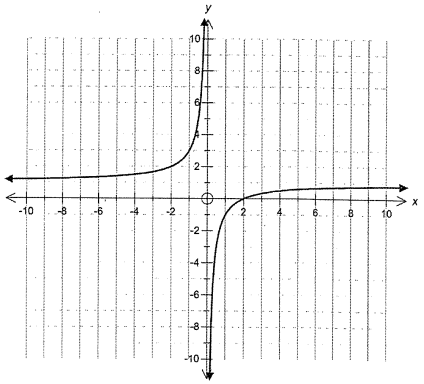
$\Rightarrow \quad 40 = \frac{k}{90} \quad \Rightarrow \quad k = 3600$ ✓

Rule: $V = \frac{3600}{P}$

$P = 120 \Rightarrow V = \frac{3600}{120}$

$= 30\text{mL}$ ✓

b) Identify the equation of the graphed function.



$y = \frac{a}{x} + 1$ ✓

Sub $(2,0)$:

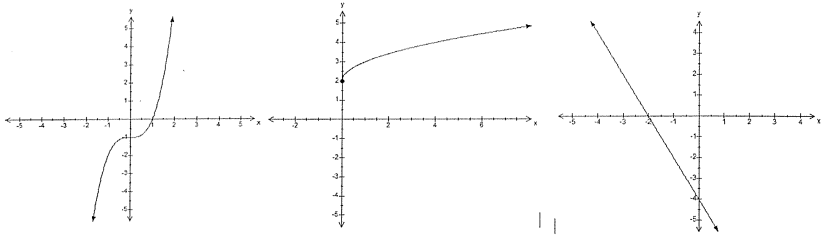
$0 = \frac{a}{2} + 1$

$\Rightarrow \quad a = -2$ ✓

ü $\quad y = -\frac{2}{x} + 1$ ✓

Question 8 **[2, 4 = 6 marks]**

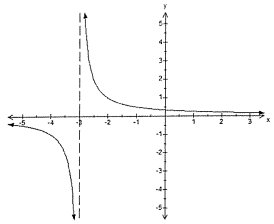
The graphs of 5 functions are shown below.



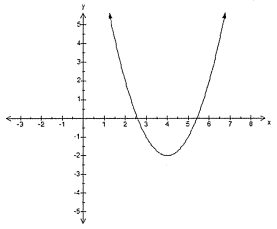
Graph A

Graph B

Graph C



Graph D



Graph E

a) Match each graph above to its corresponding equation below.

Equation	$y=\frac{1}{x+a}$	$y=b+\sqrt{x}$	$y=(x-c)^2+d$	$y=x^3+e$	$y=fx+g$
Graph	D	B	E	A	C

(-1/mistake)

(b) Find the value of each of the constants a, b, c, d, e, f and g in the equations above.

a: asymptote @ $x=-3$ $\Rightarrow a=3$

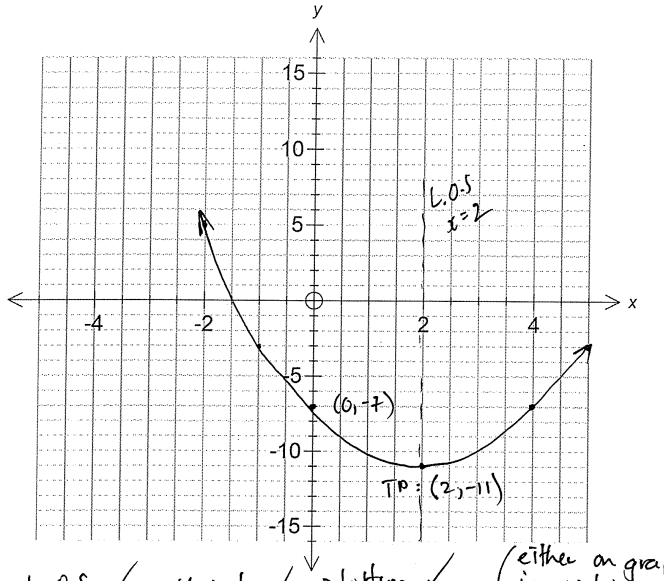
b: translated up +2 $\Rightarrow b=2$

c;d: TP @ (4,2) $\Rightarrow c=4, d=-2$

e: translated down 1 $\Rightarrow e=-1$

f,g: $m=-2$, y-int $=-4$ $\Rightarrow f=-2, g=-4$

(-1/mistake)



TP ✓ L.O.S ✓ y-int ✓ plotting ✓ (either on graph or in working OK)

b) Use **the discriminant** to show the equation $y = x^2 - 4x - 7$ has two roots.

$\Delta = b^2-4ac = 16-4(1)(-7) = 44$ ✓

As $\Delta > 0$, the equation has 2 roots. ✓

c) If the graph is to have only one root, the graph will need to be translated upwards d units.

i) What is the value of d?

11 ✓

ii) What is the equation of the new graph?

$y = x^2-4x+4$ ✓

Question 6 [2, 2, 3, 4 = 11 marks]

Solve the following using any appropriate method or show that there is no real solution. Give exact answers and simplify where possible.

a) $x^2 + 9 = 25$

$\Rightarrow x^2 = 16$

$\Rightarrow x = \pm 4$ ✓✓

b) $6x^2 - 11x = -3$

$\Rightarrow 6x^2 - 11x + 3 = 0$

$\Rightarrow (3x - 1)(2x - 3) = 0$ ✓

$\Rightarrow x = \frac{1}{3}$ or $x = \frac{3}{2}$ ✓

c) $3x^2 - 2x - 2 = 0$

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \frac{2 \pm \sqrt{4 - 4 \times 3 \times (-2)}}{6}$ ✓

$= \frac{2 \pm \sqrt{28}}{6}$

$= \frac{2 \pm 2\sqrt{7}}{6}$ ✓

$= \frac{1 \pm \sqrt{7}}{3}$ ✓

d) $2x^3 - 3x^2 - 8x - 3 = 0$

$x = 1 \Rightarrow f = -12$ ✗

$x = -1 \Rightarrow f = -2 - 3 + 8 - 3$

$= 0$ ✓

$\Rightarrow (x + 1)$ is a factor

ie $(x + 1)(2x^2 - 5x - 3) = 0$ ✓

$\Rightarrow (x + 1)(2x + 1)(x - 3) = 0$ ✓

$\Rightarrow x = -1, -\frac{1}{2}$ or 3 ✓

END OF SECTION 1

YEAR 11 MATHEMATICS METHODS UNIT 1

TEST 1
TERM 1, 2018
Test date: Tuesday 20th of February

APPLECROSS
SENIOR HIGH SCHOOL

STUDENT NAME: _____

25

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 2 marks, valid working or justification is required to receive full marks.

Section 2: Resource – Rich

Working time: 25 minutes

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

Question 7 [1, 2 = 3 marks]

The graph of the function $y = g(x)$ is show on the right. On the same axes, sketch and label graphs of

a) $y = \frac{g(x)}{2}$ ✓

b) $y = -g(x - 1)$ translated +1 ✓ reflected ✓