1. (a) (I) $\frac{1}{2^4} + \frac{1}{8}$ or $\frac{1}{16} + \frac{1}{8}$ M1   (II) $\left(\sqrt[4]{\frac{81}{16}}\right)^3$ or $\left(\frac{3}{2}\right)^3$ M1

     $\frac{3}{16}$ A1 c.a.o $\frac{27}{8}$ A1 c.a.o

(b) $\frac{16x^2y^4}{8x^3}$ M1

     $2y^4x^{-1}$ o.e. A1

2. (a) $\sqrt{25}\sqrt{6}$, $\sqrt{9}\sqrt{6}$, $5\sqrt{6}$, $3\sqrt{6}$ either M1
one
     $2\sqrt{6}$ A1 c.a.o

(b) $\frac{21\sqrt{7}}{\sqrt{7}\sqrt{7}}$ or $\frac{21\sqrt{7}}{7}$ M1

     $3\sqrt{7}$ A1 c.a.o

3. (a) $(x-2)^2 \ldots -20$ B1, B1

(b) $x-2 = \pm\sqrt{20}$ M1

     $x = 2\pm\sqrt{20}$ OR $x = 2\pm2\sqrt{5}$ A1

4. $y = 7-5x$ B1   • SIMILARLY FOR OTHER SUBSTITUTIONS

     $3x^2 + (7-5x)^2 = 21$ M1

     $28x^2 - 70x + 28 = 0$
OR $4x^2 - 10x + 4 = 0$
OR $14x^2 - 35x + 14 = 0$ M1
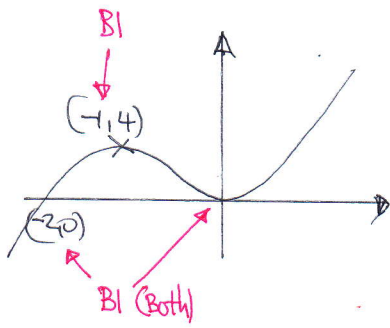OR $2x^2 - 5x + 2 = 0$

     $(2x-1)(x-2)$ A1

     $x = 2, \frac{1}{2}$ (BOTH)   A1
     $y = -3, \frac{9}{2}$ (BOTH)   A1

IF NEITHER IS AWARDED, AWARD (M1) FOR $(2,-3)$
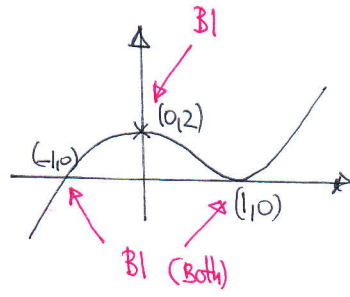OR
$(\frac{1}{2}, \frac{9}{2})$
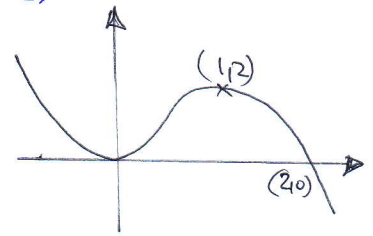OR FOR SUBSTITUTING "THEIR x OR y" TO OBTAIN THE OTHER

5 (a)

BI

(-1,4)
(-2,0)

BI (Both)

INCORRECT SHAPE B0,B0

(b)

BI

(0,2)
(-1,0)
(1,0)

BI (Both)

INCORRECT SHAPE B0,B0,

(c)

(1,2)
(2,0)

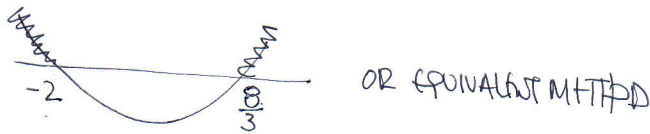BI, CORRECT SHAPE (REFLECTION)
BI, (1,2) AND (2,0) AND TOUCHING AT THE ORIGIN

6.

• $b^2 - 4ac < 0$ OR $8^2 - 4(3p-2) \times p < 0$ M1

$12p^2 - 8p - 64 > 0$ OR $3p^2 - 2p - 16 > 0$ M1

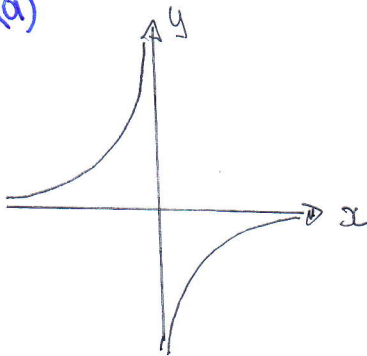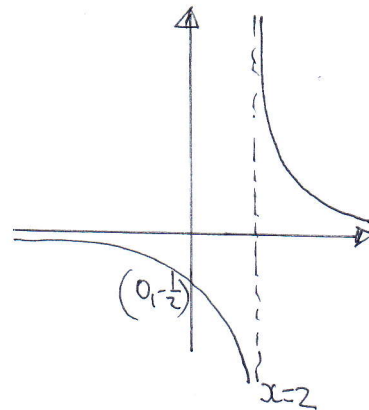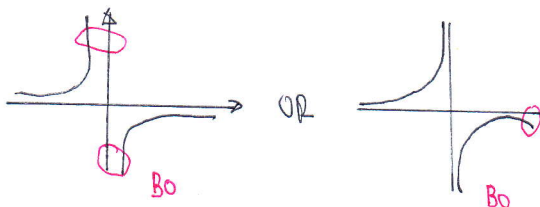$(3p - 8)(p + 2)$ B1

C.V SEEN OR IMPLIED $-2, \frac{8}{3}$ A1

-2 $\frac{8}{3}$ OR EQUIVALENT METHOD   M1

$p < -2$ OR $p > \frac{8}{3}$ A1 dep

ALLOW "AND"

DO NOT ACCEPT $-2 > p > \frac{8}{3}$
DO NOT ALLOW ANSWER IN x

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7. (a)

CORRECT SHAPE IN CORRECT QUADRANTS B1

   OR

B0   B0

$(0, -\frac{1}{2})$
$x=2$

B1 RECIPROCAL SHAPE (CAREFUL & CORRECT)
B1 TRANSLATION "RIGHT"
B1 $(0, -\frac{1}{2})$
B1 $x = 2$ MARKED ON SKETCH OR WRITTEN

8. (a) $\dfrac{1-3}{3+1}$ or $\dfrac{5-1}{5-3}$ M1

$-\dfrac{1}{2}$ or 2 A1

AS GRADIENTS ARE NEGATIVE RECIPROCALS OF EACH OTHER $AB \perp BC$ E1 o.e.

(b)
$$y-1 = 2(x-3)$$
OR
$$y-5 = 2(x-5)$$
OR
$$y = 2x-5$$
A2 o.e.

IF A2 IS NOT AWARDED AWARD A1 FOR CORRECT USE OF GRADIENT OR CORRECT USE OF BOTH CO-ORDINATES OF $(3,1)$ OR $(5,5)$

(c) $(1,2)$ B1

ATTEMPT TO REARRANGE OR $y = \dfrac{1}{3}x + \dfrac{10}{3}$ M1

$$y-2 = \dfrac{1}{3}(x-1)$$
OR
$$3y = x+5$$
OR
$$y = \dfrac{1}{3}x + \dfrac{5}{3}$$
A2 o.e.

IF A2 IS NOT AWARDED AWARD A1, ACCORDING TO THE NOTE ABOVE

(d) $(4,3)$ B2

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9. (a) $u_3 - u_2 = u_2 - u_1$ or $(4k+1)-(2k+5) = (2k+5)-(k-2)$ M1

$2k-4 = k+7$ M1

$k=11$ A1*

(b) $a=9$ $d=18$ BOTH SEEN OR IMPLIED A1

$9 + 40 \times 18$ M1

729 A1

(c) $\dfrac{n}{2}(2\times9 + (n-1)\times18)$ or $\dfrac{n}{2}(18 + 18n - 18)$ M1

$\dfrac{n}{2} \times 18n$ or $9n^2$ M1

$(3n)^2 +$ COMMENT   A1

10. (a) EVALUATES $f'(-1)$ OR -9 SEEN **M1**

$$\left. \begin{array}{c} y - 0 = -9(x+1) \\ \text{OR} \\ y = -9x - 9 \end{array} \right\} \textbf{A2}$$

IF A2 IS NOT AWARDED, AWARD A1 IF THE GRADIENT OR THE CO-ORDINATES $(-1,0)$ ARE USED CORRECTLY

(b) $\dfrac{8x^3}{x^2} - \dfrac{1}{x^2}$ OR $(8x^3-1)x^{-2}$ **M1**

$8x - x^{-2}$ **A1**

$f''(x) = 8 + 2x^{-3}$ OR $8 + \dfrac{2}{x^3}$ **A1**

(c) (I) $\displaystyle\int 8x + 2x^{-3}\, dx$ **M1**

$4x^2 + x^{-1} + C$ **B3**

ATTEMPTS $(-1, 0)$ OR $0 = 4(-1)^2 - 1 + C$ **M1**

$C = -3$ **A1**

$f(x) = 4x^2 + \dfrac{1}{x} - 3$ **A1** O.E.

(II) $y = 0$ OR their $f(x) = 0$ **M1**

$4x^3 + 1 - 3x = 0$ **M1**

$(x+1)(\ldots)$ OR DIVIDES BY $x+1$ **M1**

$4x^2 - 4x + 1$ **A1**

$x = \dfrac{1}{2}$ OR $Q\left(\dfrac{1}{2}, 0\right)$ **A1**