YORKSHIRE MATHS TUTOR

1. Factorise completely

$$x^3 - 4x^2 + 3x.$$

(3)

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

$= x(x - 3)(x - 1)$

Leave blank

3. Find the set of values of x for which

(a) $4x - 5 > 15 - x$

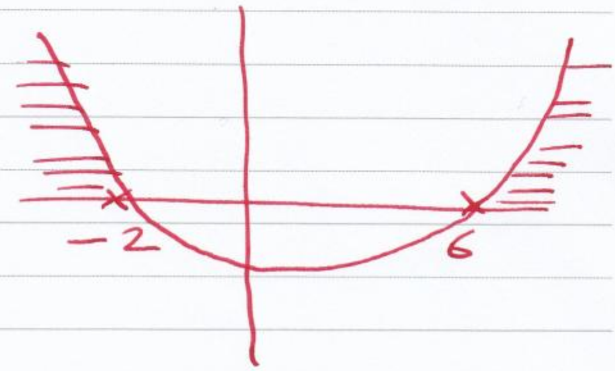
(2)

(b) $x(x-4) > 12$

(4)

a) $4x - 5 > 15 - x$
$4x + x > 15 + 5$
$5x > 20$
$x > 4$

b) $x(x-4) > 12$
$x^2 - 4x - 12 > 0$
$(x-6)(x-2) > 0$



region we want is where curve is above x - axis

$x < -2$ or $x > 6$

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2. Factorise completely

$$x^3 - 9x.$$

(3)

$x^3 - 9x \equiv x(x^2 - 9)$

$\equiv x(x+3)(x-3)$

Q2

(Total 3 marks)

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4. Find the set of values of x for which

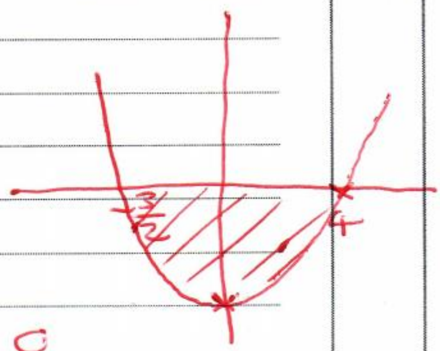
(a) $4x - 3 > 7 - x$ **(2)**

(b) $2x^2 - 5x - 12 < 0$ **(4)**

(c) **both** $4x - 3 > 7 - x$ **and** $2x^2 - 5x - 12 < 0$ **(1)**

a) $4x - 3 > 7 - x$
$4x + x > 7 + 3$
$5x > 10$
$x > 2$

b) $2x^2 - 5x - 12 < 0$
$(2x + 3)(x - 4) < 0$



Find critical values

$2x + 3 = 0$ or $x - 4 = 0$
$x = -\frac{3}{2}$ $x = 4$

Area we want is the shaded area on the sketch
$-\frac{3}{2} < x < 4$

c) To satisfy $x > 2$ and $-\frac{3}{2} < x < 4$

$2 < x < 4$

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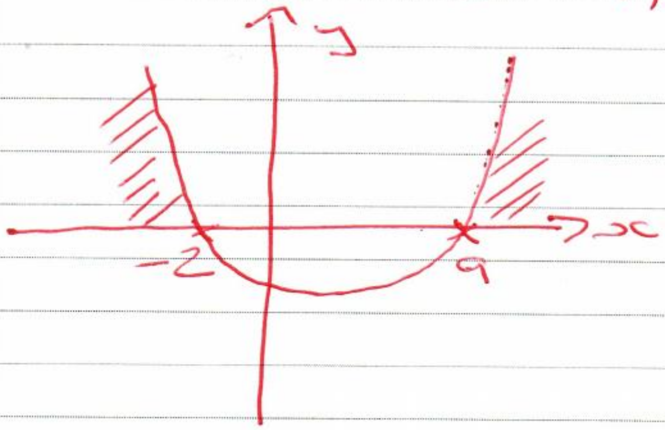
2. Find the set of values of x for which

$$x^2 - 7x - 18 > 0.$$

(4)

$(x-9)(x+2) > 0$

Critical values are $x = 9$, $x = -2$



The curve is greater than 0 for

$x < -2$ or $x > 9$

Q2

(Total 4 marks)

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9. Given that $f(x) = (x^2 - 6x)(x - 2) + 3x$,

(a) express f(x) in the form $x(ax^2 + bx + c)$, where a, b and c are constants.

(3)

(b) Hence factorise f(x) completely.

(2)

(c) Sketch the graph of $y = f(x)$, showing the coordinates of each point at which the graph meets the axes.

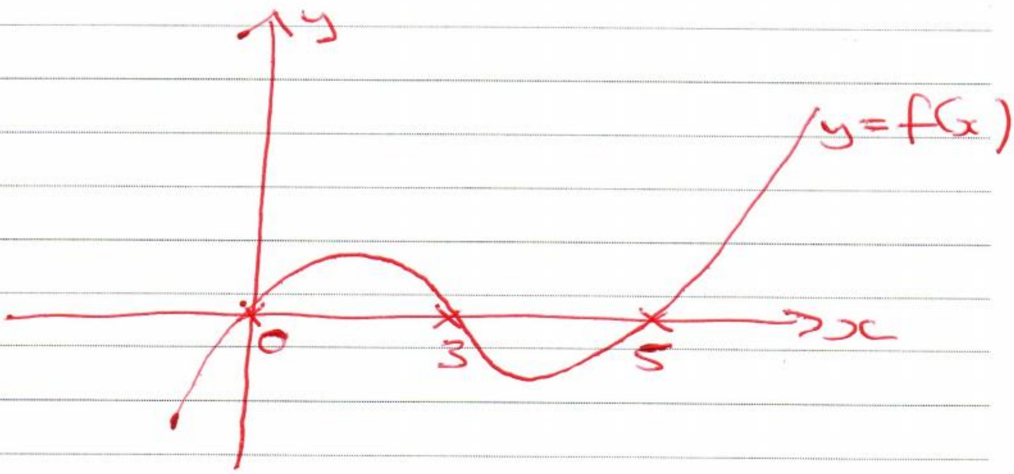
(3)

a) $f(x) = (x^2 - 6x)(x-2) + 3x$
$= x^3 - 2x^2 - 6x^2 + 12x + 3x$
$= x^3 - 8x^2 + 15x$
$= x(x^2 - 8x + 15)$

in form $x(ax^2 + bx + c)$ where
$a = 1$, $b = -8$, $c = 15$

b) $f(x) = x(x-5)(x-3)$

c)



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3. Find the set of values of x for which

(a) $3(x-2) < 8-2x$

(2)

(b) $(2x-7)(1+x) < 0$

(3)

(c) both $3(x-2) < 8-2x$ **and** $(2x-7)(1+x) < 0$

(1)

a) $3(x-2) < 8-2x$

$3x-6 < 8-2x$

$3x+2x < 8+6$

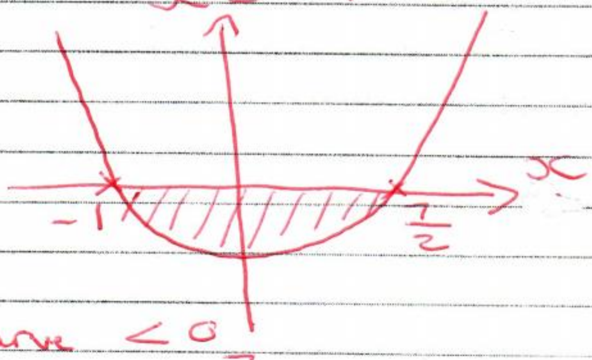
$5x < 14$

$x < \frac{14}{5}$

b) $(2x-7)(1+x) < 0$

Critical values are

$x = \frac{7}{2}$ $\quad x = -1$



Values where curve < 0

are $-1 < x < \frac{7}{2}$

c) $-1 \quad 0 \quad \frac{14}{5} \quad \frac{7}{2}$

a)

b)

Region which satisfies both is

$-1 < x < \frac{14}{5}$

H 3 5 3 8 3 A 0 4 2 8

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9. The equation

$$(k+3)x^2 + 6x + k = 5, \text{ where } k \text{ is a constant,}$$

has two distinct real solutions for x.

(a) Show that k satisfies

$$k^2 - 2k - 24 < 0$$

(4)

(b) Hence find the set of possible values of k.

(3)

a) $(k+3)x^2 + 6x + k - 5 = 0$

2 real roots $b^2 - 4ac > 0$

$a = k+3$, $b = 6$, $c = k-5$

$6^2 - 4 \times (k+3)(k-5) > 0$

$36 - 4(k^2 - 5k + 3k - 15) > 0$

$36 - 4(k^2 - 2k - 15) > 0$

$36 - 4k^2 + 8k + 60 > 0$

$96 + 8k - 4k^2 > 0$

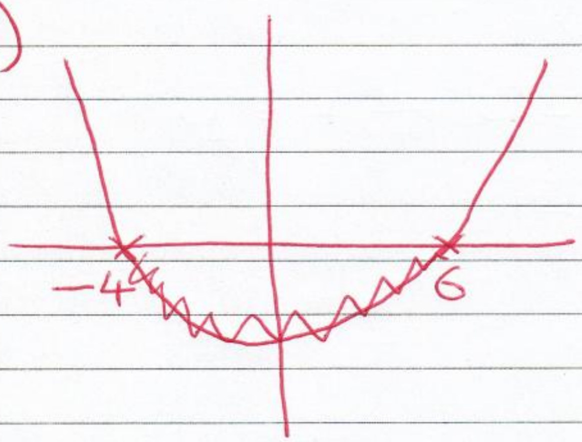
$\div$ through by 4

$24 + 2k - k^2 > 0$

$0 > k^2 - 2k - 24$

$\therefore k^2 - 2k - 24 < 0$ as required

b)



$k^2 - 2k - 24 < 0$

$(k-6)(k+4)$

$k = 6$, $k = -4$

We want values of k below axis as $k^2 - 2k - 24 < 0$

$\underline{\underline{-4 < k < 6}}$

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5. Find the set of values of x for which

(a) $2(3x + 4) > 1 - x$

(2)

(b) $3x^2 + 8x - 3 < 0$

(4)

a) $2(3x+4) > 1-x$

$6x + 8 + x - 1 > 0$

$7x > -7$

$\underline{\underline{x > -1}}$

b) $3x^2 + 8x - 3 < 0$

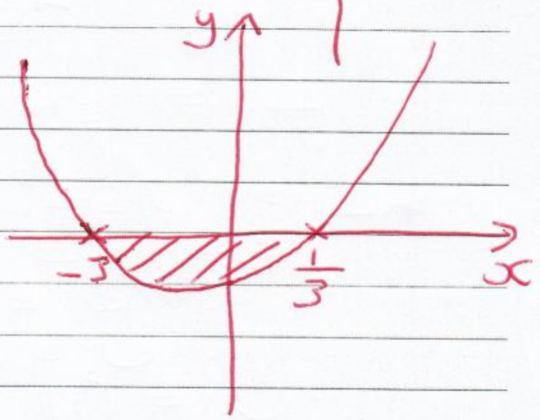
$(3x-1)(x+3) < 0$

Critical values

$3x - 1 = 0$ $\quad$ $x + 3 = 0$

$x = \frac{1}{3}$ $\quad$ $x = -3$

< sign means x values below x-axis



$\underline{\underline{-3 < x < \frac{1}{3}}}$

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