Staff

NEWINGTON COLLEGE

IN FIDE SCIENTIAM

Common Assessment 1

Year 11

2009

MATHEMATICS

Extension 1

Time allowed - 60 minutes

DIRECTIONS TO CANDIDATES:

All questions may be attempted.
In every question, show all necessary working.
Marks may not be awarded for careless or badly arranged work.
Approved silent calculators may be used.
The answers to the four questions in this paper are to be returned in separate bundles clearly marked Question 1, Question 2 etc.
Each bundle must show the candidate's computer number.
Start each question on a new page.
The questions are not necessarily arranged in order of difficulty. Candidates are advised to read the whole paper carefully at the start of the examination.
Unless otherwise stated candidates should leave their answers in simplest exact form.

Outcomes to be Assessed :

P3 Performs routine arithmetic and algebraic manipulation involving surds, simple rational expressions and trigonometric identities.

P5 Understands the concept of a function and the relationship between a function and its graph.

PE3 solves problems involving permutations and combinations, inequalities, polynomials, circle geometry and parametric representations.

QUESTION ONE *(13 Marks)* **Marks**

(a) Simplify: $-3x^3 \times 4x^2$ 1

(b) Factorise (i) $x^2 - 8x - 9$ 1+2+2

(ii) $6x^3 - 54xy^2$

(iii) $(x+h)^3 - 1$

(c) Simplify: $\dfrac{3}{k^2-4} - \dfrac{2}{k^2-3k+2}$ 3

(d) Solve for x: $\dfrac{5}{x} + \dfrac{3}{2x} = 2$ 2

(e) If $s = \dfrac{1}{2}(u+v)t$, find u. 2

QUESTION TWO *(13 Marks)* **Start a new page**

(a) Write 0.00000725 number in scientific notation. 1

(b) Express $0 \cdot 2\dot{5}\dot{7}$ as a fraction in lowest terms. 2

(c) Solve the following pair of simultaneous equations: 2

$$3x - y = 5$$
$$5x + 3y = -8$$

(d) Express with a rational denominator: 2+2

(i) $\dfrac{14}{\sqrt{7}}$

(ii) $\dfrac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}}$

(e) If $x = \sqrt{5} - 2$, find the value of $\dfrac{x^2+2x}{x+3}$, expressing your answer with a rational denominator. 4

Question Three on Page 2 ...

QUESTION THREE *(10Marks)* **Start a new page** **Marks**

(a) State the natural domain of each of the following functions: 2

(i) $f(x) = \dfrac{1}{x+2}$ (ii) $f(x) = \sqrt{2x+3}$

(b) Sketch each of the following, showing any intercepts with the axes, asymptotes or vertices: 8

(i) $y = \sqrt{25 - x^2}$ (ii) $y = 3^x + 2$

(iii) $y = -(x-2)^2 + 3$ (iv) $y = \dfrac{1}{x-4} - 1$

QUESTION FOUR *(12Marks)* **Start a new page**

(a) (i) Solve for x if $|2x-5| = 3$ 2

(ii) Solve for x if $|8x-9| = 5x$ 3

(b) By first factorizing the LHS, find the solution for $3x^2 - 28x + 25 > 0$ 2

(c) If $f(x) = \begin{cases} x+1, & x \geq 0 \\ \dfrac{1}{x}, & x < 0 \end{cases}$ then $f(0)$ equals: 2

(d) Test if the function $f(x) = \dfrac{3x}{3+x^2}$ is odd, even or neither 2

(e) Find the largest possible domain of $x = -\sqrt{4-y^2}$ 2

END OF PAPER

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QUESTION ONE *(13 Marks)*

Marks

(a) Simplify: $-3x^3 \times 4x^2$ **1**

$= -12x^5$

(b) Factorise **1+2+2**

(i) $x^2 - 8x - 9$

$= \underline{(x-9)(x+1)}$

(ii) $6x^3 - 54xy^2$

$= 6x(x^2 - 9y^2)$

$= \underline{6x(x-3y)(x+3y)}$

(iii) $(x+h)^3 - 1$

$= (x+h)^3 - (1)^3$

$= [(x+h)-1][(x+h)^2 + (x+h)1 + 1^2]$

$= \underline{(x+h-1)(x^2 + 2xh + h^2 + x + h + 1)}$

(c) Simplify: $\dfrac{3}{k^2-4} - \dfrac{2}{k^2-3k+2}$ **3**

$= \dfrac{3}{(k-2)(k+2)} - \dfrac{2}{(k-2)(k-1)}$

$= \dfrac{3(k-1) - 2(k+2)}{(k-2)(k+2)(k-1)}$

$= \underline{\dfrac{k-7}{(k-2)(k+2)(k-1)}}$

(d) Solve for x: $\dfrac{5}{x} + \dfrac{3}{2x} = 2$ **2**

$\dfrac{10}{2x} + \dfrac{3}{2x} = \dfrac{4x}{2x}$ $\quad 4x = 13 \quad x = \dfrac{13}{4} \quad x = 3\dfrac{1}{4}$

(e) If $s = \dfrac{1}{2}(u+v)t$, find u. **2**

$2s = (u+v)t \quad \dfrac{2s}{t} = (u+v) \quad u = \dfrac{2s}{t} - v$

QUESTION TWO *(13 Marks)* **Start a new page**

(a) Write 0.00000725 number in scientific notation. **1**

$= \underline{7.25 \times 10^{-6}}$

(b) Express $0\cdot2\dot{5}\dot{7}$ as a fraction in lowest terms. **2**

$10 \times 0\cdot2\dot{5}\dot{7} = 2.575757....$

$1000 \times 0\cdot2\dot{5}\dot{7} = 257.5757....$

$\therefore 990 \times 0\cdot2\dot{5}\dot{7} = 255 \qquad 0\cdot2\dot{5}\dot{7} = \dfrac{255}{990} = \dfrac{17}{66}$

(c) Solve the following pair of simultaneous equations: **2**

$3x - y = 5$ (i)

$5x + 3y = -8$ (ii)

$9x - 3y = 15$ (i)x3

$14x = 7$ add

$\underline{x = \dfrac{1}{2}}$

$3\left(\dfrac{1}{2}\right) - y = 5$

$\left(\dfrac{3}{2}\right) - 5 = y$

$\underline{y = \dfrac{-7}{2}}$

(d) Express with a rational denominator: **2+2**

(i) $\dfrac{14}{\sqrt{7}} = \dfrac{14\sqrt{7}}{\sqrt{7}\sqrt{7}} = \dfrac{14\sqrt{7}}{7} = \underline{2\sqrt{7}}$

(ii) $\dfrac{3\sqrt{2}}{\sqrt{5}-\sqrt{2}} = \dfrac{3\sqrt{2}(\sqrt{5}+\sqrt{2})}{(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})} = \dfrac{3\sqrt{10}+6}{5-2} = \dfrac{3\sqrt{10}+6}{3} = \sqrt{10}+2$ -1 IF NOT Cancelled

(e) If $x = \sqrt{5} - 2$, find the value of $\dfrac{x^2+2x}{x+3}$, expressing your answer with a rational denominator. **4**

$= \dfrac{(\sqrt{5}-2)^2 + 2(\sqrt{5}-2)}{(\sqrt{5}-2)+3}$

$= \dfrac{5 - 4\sqrt{5} + 4 + 2\sqrt{5} - 4}{\sqrt{5}+1}$

$= \dfrac{5 - 2\sqrt{5}}{\sqrt{5}+1} \cdot \dfrac{(\sqrt{5}-1)}{(\sqrt{5}-1)}$ ✓ Rationalize

$= \dfrac{5\sqrt{5} - 5 - 10 + 2\sqrt{5}}{5-1}$

$= \underline{\underline{\dfrac{7\sqrt{5}-15}{4}}}$

Question Three on Page 2 ...

QUESTION THREE *(10Marks)* Start a new page

Marks

(a) State the natural domain of each of the following functions: 2

(i) $f(x)=\dfrac{1}{x+2}$

$x+2 \neq 0$ (undefined)

$x \neq -2$

ALL x except $x=2$

① mark

(ii) $f(x)=\sqrt{2x+3}$

$2x+3 \geq 0$

$2x \geq -3$

$x \geq -\frac{3}{2}$

① mark

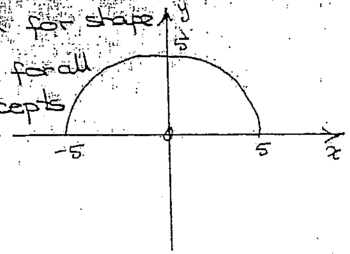
(b) Sketch each of the following, showing any intercepts with the axes, asymptotes or vertices: 8

*general comment
- diagrams need to be larger and axes and origin labelled
- hyperbolas and exponentials shouldn't run parallel to the asymptotes.

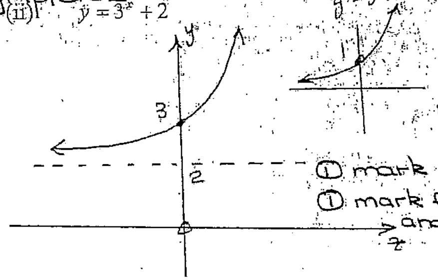
(i) $y=\sqrt{25-x^2}$

① mark for shape

① mark for all intercepts



(ii) $y=3^x+2$



① mark for shape

① mark for asymptote and y-intercept

(iii) $y=-(x-2)^2+3$

Vertex at $x-2=0$, $x=2$, $y=3$

x-inter at $y=0$

$0=-(x-2)^2+3$

$x-2=\pm\sqrt{3}$

$x=2\pm\sqrt{3}$

y-inter at $x=0$

$y=-(-2)^2+3$

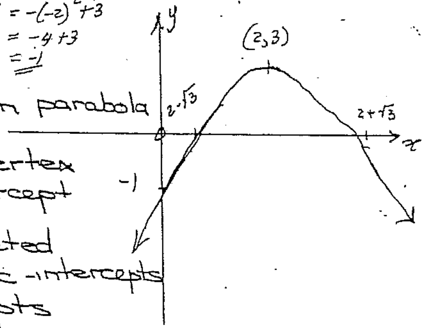
$=-4+3$

$=-1$

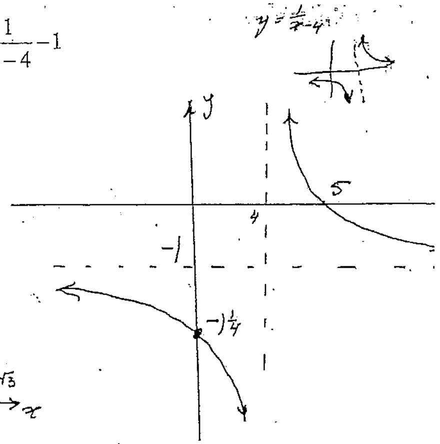
① mark for concave down parabola

① mark for vertex and y-intercept

No mark deducted for incorrect x-intercepts or x-intercepts missing



(iv) $y=\dfrac{1}{x-4}-1$



x-inter

$y=0=\frac{1}{x-4}-1$

$\frac{1}{x-4}=1$

$1=x-4$

$x=5$

y-inter

$x=0$

$y=\frac{1}{0-4}-1$

$=-1\frac{1}{4}$

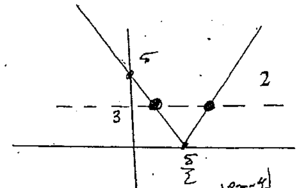
① mark for shape

① mark for both asymptotes and intercepts

QUESTION FOUR *(12Marks)* Start a new page

(a) (i) Solve for x if $|2x-5|=3$ 2

Either $2x-5=3$, $2x=8$, $x=4$ OR $-(2x-5)=3$, $2x-5=-3$, $2x=2$, $x=1$



(ii) Solve for x if $|8x-9|=5x$

$8x-9=5x$

$3x=9$

$x=3$

check $8(3)-9=15$ ✓ $5x=5(3)=15$

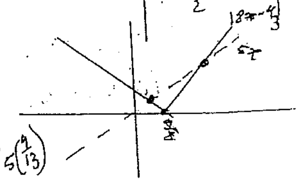
$-(8x-9)=5x$

$8x-9=-5x$

$13x=9$

$x=\frac{9}{13}$

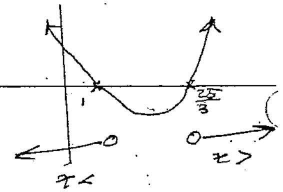
check $8\left(\frac{9}{13}\right)-9=-\frac{4}{13}$, $\left|-\frac{4}{13}\right| \neq 5\left(\frac{9}{13}\right)$



(b) By first factorizing the LHS, find the solution for $3x^2-28x+25>0$ 2

$(3x-25)(x-1)>0$

ANS $x<1$ OR $x>\frac{25}{3}$



(c) If $f(x)=\begin{cases} x+1, & x\geq 0 \\ \dfrac{1}{x}, & x<0 \end{cases}$ then $f(0)$ equals: 2

$f(x)=x+1$

$f(0)=0+1$

$f(0)=1$

(d) Test if the function $f(x)=\dfrac{3x}{3+x^2}$ is odd, even or neither 2

$f(-x)=\dfrac{3(-x)}{3+(-x)^2}$

$=\dfrac{-3x}{3+x^2}$

$f(x)=-\left(\dfrac{3x}{3+x^2}\right)$

$f(-x)=-f(x)$

$\therefore$ Even

(e) Find the largest possible domain of $x=-\sqrt{4-y^2}$ 2

consider:

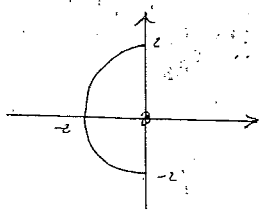
$x^2=4-y^2$

$x^2+y^2=4$

circle rad 2.

Centre origin

But $x=-\sqrt{}$



$-2\leq x\leq 0$

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