RADLEY

Entrance Scholarships

MATHEMATICS I

January 2020

Time allowed – 1 hour

You may try the questions in any order

No calculating aids may be used

Show all your working

1.

Give the answers to the following as fractions in their simplest form

i. $\frac{21}{8} \times \frac{12}{7}$ *(3 marks)*

ii. $3\frac{3}{8} \div \frac{9}{22}$ *(3 marks)*

iii. $3\frac{3}{5} - 2\frac{4}{15}$ *(3 marks)*

2.

Solve each of these equations for *x*

a. $3(4-2x) - 7(3x-14) = 29$ *(3 marks)*

b. $\frac{4x+3}{5} - \frac{7-8x}{6} = \frac{1}{2}$ *(4 marks)*

c. $x^3 - 3x^2 - 4x = 0$ *(4 marks)*

d. $(x^2-13)^2 + (x^2-13) - 12 = 0$ *(5 marks)*

Rearrange the following formula to make *x* the subject

e. $\frac{2x-3a}{a-x} = \frac{b-2x}{x-2a}$ *(6 marks)*

3.

Work out as simply as possible.

a. $47^2 - 33^2$ *(2 marks)*

b. $\frac{217+213}{217^2-213^2}$ *(3 marks)*

c. $\frac{53^3-106^2+3\times53}{52}$ *(5 marks)*

Hint for c. Can the numerator be factorised?

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a. Multiply out and simplify

i. $(2a-5b)^2$ *(3 marks)*

ii. $(2x-3y)(4x^2-3xy+2y)$ *(4 marks)*

b. Factorise fully

i. $35a^4b^2-63a^7b^3$ *(3 marks)*

ii. $2xz-2yz+3x-3y$ *(3 marks)*

iii. $52y^2-208x^4$ *(3 marks)*

iv. $x^2-2x-48$ *(3 marks)*

c. Simplify

i. $\frac{16x^2-64y^2}{4xz-8yz}$ *(3 marks)*

ii. $(6x^2y^3)^2 \div \frac{2y^3}{3x^2}$ *(3 marks)*

5.

Solve each of these pairs of equations for *x* and *y*

a. $4x - 3y = 46$
$2y = 9 - 3x$ *(4 marks)*

b. $\frac{1}{2}x + \frac{2}{3}y = \frac{55}{6}$

$\frac{1}{4}x - \frac{1}{12}y = \frac{5}{3}$ *(4 marks)*

c. $5x - 3y = \frac{73}{21}$

$4x + 2y = \frac{52}{63}$ *(6 marks)*

6.

Solve each of these equations for *x* using algebraic methods.

a. $x^2 - 18x + 45 = 0$ *(4 marks)*

b. $6x^2 - 7x - 24 = 0$ *(4 marks)*

c. $(x^2 - 7)(x + 3) - x(x + 4)^2 + 9 = 0$ *(6 marks)*

d. $\frac{x-3}{x+2} + \frac{2x-6}{x-3} = \frac{5}{2}$ *(6 marks)*

Total 100 marks