20. (a) Rationalize the denominator: $\frac{\sqrt{2}}{2\sqrt{5}+\sqrt{3}}$. *(4 marks)*

(b) Simplify: $\sqrt{12} \times 3\sqrt{60} \times \sqrt{45}$. *(4 marks)*

(c) Simplify: $\sqrt{8} \times \sqrt{50} + \sqrt{121}$. *(4 marks)*

(d) Simplify: $\frac{5\sqrt{7}}{\sqrt{45}} \times \frac{2\sqrt{3}}{\sqrt{21}}$ *(3 marks)*

END.

ANSWER KEY FOR 2012

MATHEMATICS 009
SECTION A

1.
2 | 900
2 | 450
3 | 225
3 | 75
5 | 25
5 | 5
5 | 1

So $900 = 2^2 \times 3^2 \times 5^2$

$\sqrt{900} = \sqrt{2^2 \times 3^2 \times 5^2}$

$= 2 \times 3 \times 5 = 30$

2. a) $45^2 - 1.55^2$

$= (3.45+1.55)(3.45-1.55)$

$= (5.00)(1.90)$

$= 9.5$

b) $0.9 \div 30 = \frac{9}{10} \times \frac{1}{30}$

$= \frac{3}{100 \times 10} = 0.003$

3.

300 students ⇒ 17 days

1 student ⇒ 17×300

340 students ⇒ $\frac{17\ days \times 300}{340}$

= 15 days.

4. $5x^2 + 21x - 20 = 0$

$= 5x^2 + 25x - 4x - 20 = 0$

$= 5x(x+5) - 4(x+5) = 0$

$= (x+5)(5x-4) = 0$

$\therefore x + 5 = 0$ or $5x - 4 = 0$

$x = -5$ or $x = \frac{4}{5}$

5. Area of the small triangle

$= \frac{1}{2} \times 4 \times 3 = 6cm^2$

Linear scale factor $= \frac{20}{5} = 4$

Area scale factor $= 4^2 = 16$

Area of larger triangle

$= 16 \times 6 = 96cm^2$

6. $\times 3$ | $x + 2y = 40$
$3x + y = 60$

$= 3x + 6y = 120$

$- \ 3x + y = 60$

$5y = 60$

$y = 12$

$x + 24 = 40$

$x = 16.$

7. Let x and y be any point on the line.

Then the gradient of the line

$= \frac{y-3}{x-(-1)} = \frac{y-3}{x+1}$

Again the gradient of the line $= \frac{2-3}{4-(-1)} = \frac{-1}{5}$

So $\frac{y-3}{x+1} = \frac{-1}{5}$ $\therefore 5(y-3) = -1(x+1) = 5y - 15 = -x - 1$

$5y + x = 14$

8. $f(x) = ax^2 - 7$

$F(2) = a(2)^2 - 7 = 13$

So $4a - 7 = 13$

$4a = 20$

$a = 5$

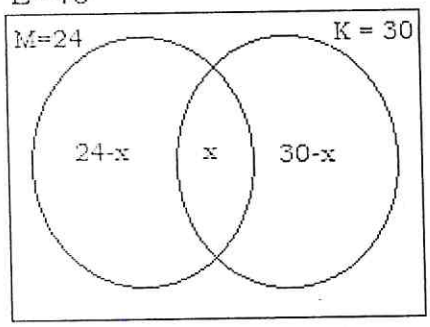
$\therefore f(x) = 5x^2 - 7$

$F(-1) = 5(-1)^2 - 7$

$= 5 - 7 = -2$

9.

E=40



$24 - x + x + 30 - x = 40$

$54 - x = 40$

$x = 14$

$\therefore$ 14 students like both mathematics and Kinyarwanda

10.

$\frac{3x}{2} \geq \frac{x}{4} - 10 = \frac{6x \geq x - 40}{4}$

$5x \geq -40$

$x \geq -8$

11.

Let one part be x cm and the other part

(x + 4)cm

$\therefore x + x + 4 = 10$

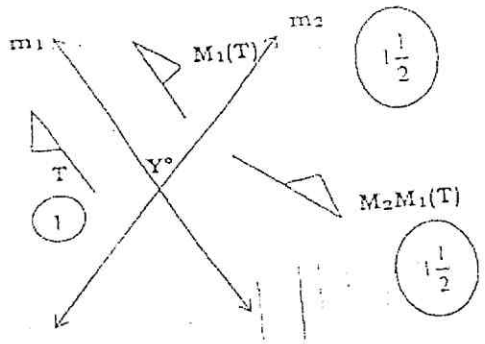
$2x + 4 + 10$

$2x + 6$

$x = 3$

one part is 3 cm and the other is (3 + 4) = 7cm

12.



13. $= 152_n = 68_{ten}$

$= (1 \times n^2) + (5 \times n^1) + (2 \times n^\circ) = 68$

$= n^2 + 5n + 2 = 68$

$= n^2 + 5n + 2 - 68 = 0$

$= n^2 + 5n - 66 = 0$

$= n^2 + 11n - 6n - 66 = 0$

$= (n^2 + 11n) + (-6n - 66) = 0$

$= n(n + 11) - 6(n + 11) = 0$

$= n - 6 = 0$ or $n + 11 = 0$

$n = 6$ $n = -11$

$\therefore n = 6$

14.

Midpoint M $= \frac{1+9}{2}, \frac{6+0}{2}$

$= 5, 3$

$\overline{MB} = \begin{bmatrix} 9-5 \\ 6-3 \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$

$= \overline{MB} = \sqrt{4^2 + 3^2}$

$= \sqrt{16 + 9}$

$\overline{MB} = \sqrt{25} = 5$

15. Diameter $= \pi D = 88cm$

$D = 88cm \times \frac{7}{22} = 28cm$

$r = \frac{28}{2} = 14cm$

$V = \pi r^2 h$

$= \frac{22}{7} \times 14cm \times 14cm \times 30$

$V = 18480cm^3$

SECTION B

16. a) $\frac{1}{x^2-1} + \frac{1}{x^2-4x+3} + \frac{1}{x-3} = 0$

$= \frac{1}{(x-1)(x+1)} + \frac{1}{(x-3)(x-1)} + \frac{1}{x-3} = 0$

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

$= x - 3 + x + 1 + x^2 - 1 = 0$

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

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

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

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

$= x = -3$

($x = 1$ is not valid)

b) $2x^3 + 5x^2 + x-2$

$2x^3 - x^2$

$6x^2 + x$

$6x^2 - 3x$

$4x - 2$

$4x - 2$

0

$x^2 + 3x + 2 = x^2 + 2x + x + 2$

$= x(x + 2) + (x + 2)$

$= (x + 2)(x + 1)$

So $2x^3 + 5x^2 + x-2 = (2x -1)(x + 2)(x + 1)$

$x = -2$ or $x = -1$ or $x = -\frac{1}{2}$

17.

Age in years	14	15	16	17	18	19	20
Frequency	5	9	13	11	12	15	8
Cumulative frequency	5	14	27	38	50	65	73

a) Median age = the $\frac{1}{2}(N + 1)^{th}$ age

= the $\frac{1}{2}(73 + 1)^{th}$

median age = the 37^{th} age.

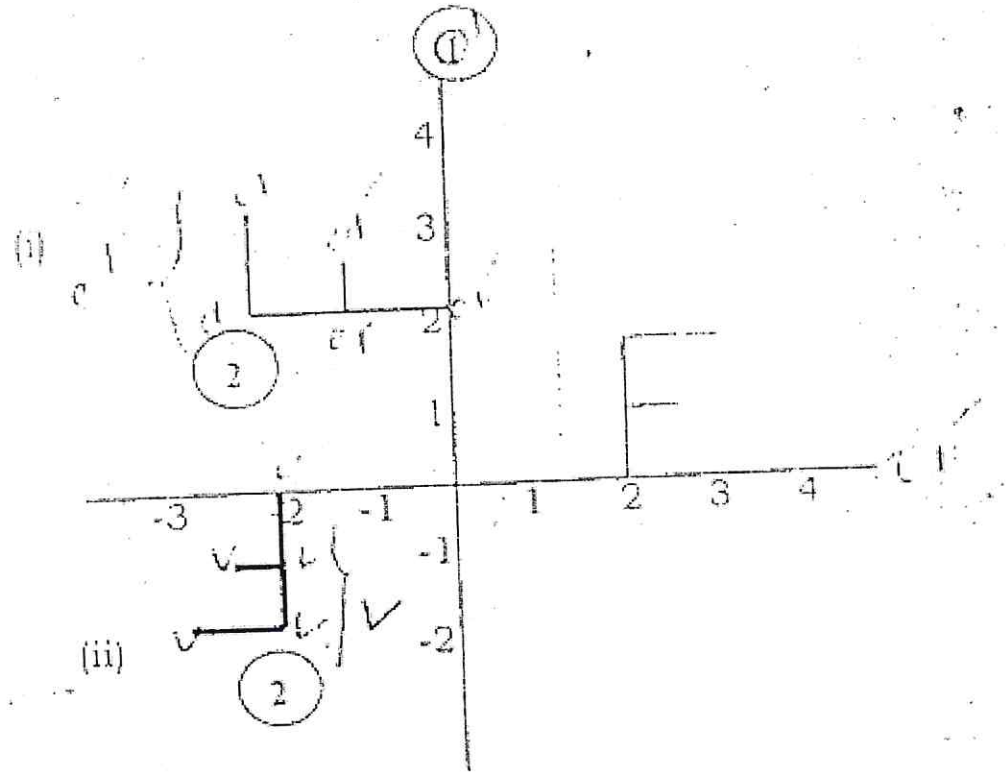
17. b)

Age (x)	Frequency (f)	Fx
14	5	70
15	9	135
16	13	208
17	11	187
18	12	216
19	15	285
20	8	160
	$\sum f = 73$	$\sum fx = 1261$

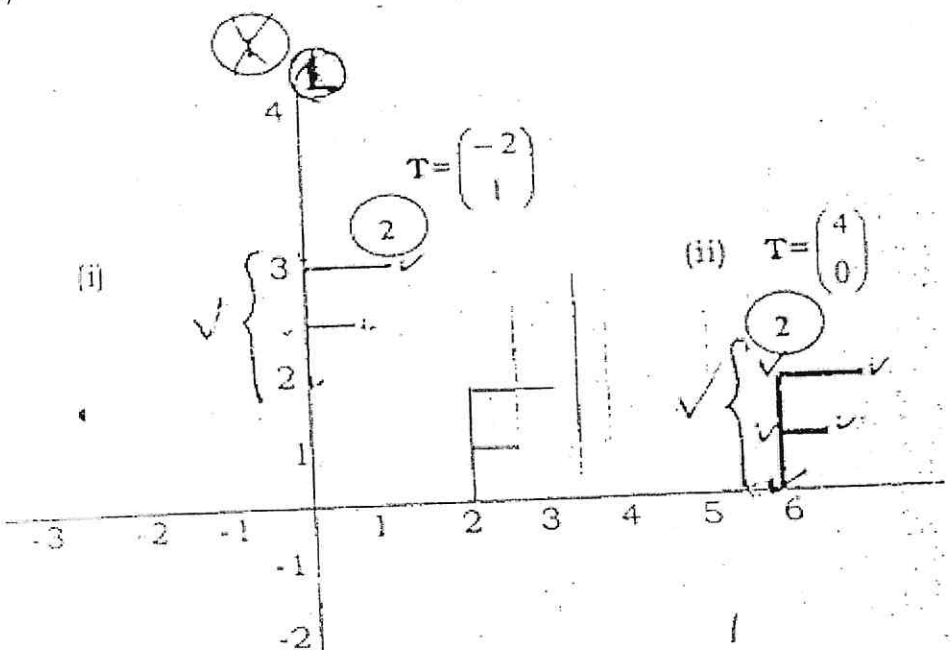
Mean age = $\frac{1261}{73} = 17.27$

18.

a)



b)



19.

a) Lateral area

= base perimeter × height

= (5+6+5+12)×10

= 28×10 = 280cm²

b) Total surface area

= lateral area + area of 2 bases

= base area = ½ × 4 × (6+12)

= 36cm²

Area of 2 bases = 2× 36 = 72cm²

Total area = 280 + 72 = 352cm²

c) Volume

= base area × height

= 36 × 10

= 360cm³

20.

a) $\frac{\sqrt{2}}{2\sqrt{5}+\sqrt{3}} = \frac{\sqrt{2}(2\sqrt{5}-\sqrt{3}}{(2\sqrt{5}+\sqrt{3})(2\sqrt{5}+\sqrt{3}} = \frac{2\sqrt{10}-\sqrt{6}}{4\times5-3}$

$= \frac{2\sqrt{10}-\sqrt{6}}{17}$

b) $\sqrt{12} \times 3\sqrt{60} \times \sqrt{45} = \sqrt{4\times3} \times 3\sqrt{4\times15} \times \sqrt{9\times5}$

$= 2\sqrt{3} \times 6\sqrt{15} \times 3\sqrt{5} = 36\sqrt{3} \times 15 \times 5 = 36\sqrt{15} \times 15$

$= 36 \times 15$

$= 540$

c) $\sqrt{8} \times \sqrt{50} + \sqrt{121}$.

$= \sqrt{4\times2} \times \sqrt{25\times2} + \sqrt{11\times11}$

$= 2\sqrt{2} \times 5\sqrt{2} + 11$

$= 10\sqrt{2\times2} + 11$

$= 10\times2 + 11$

$= 31$

d) $\frac{5\sqrt{7}}{\sqrt{45}} \times \frac{2\sqrt{3}}{\sqrt{21}} = \frac{5\sqrt{7}\times2\sqrt{3}}{\sqrt{9\times5}\times\sqrt{7}\times\sqrt{3}} = \frac{5\times2}{3\sqrt{5}}$

$= \frac{10\sqrt{5}}{3\sqrt{5}\sqrt{5}}$

$= \frac{2\sqrt{5}}{3}$

END.