

Main Examination period 2017

## **SEF026: Essential Foundation Mathematical Skills**

**Duration: 2 hours**

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**You should attempt ALL questions.**

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Record each answer by ticking the corresponding box on the answer sheet provided. Do not use pencil or red ink.

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**Exam papers must not be removed from the examination room.**

**Examiners: S. Majid**

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**Question 1.** Compute the remainder of the following division:  $1017 \div 11$ .

- [a] 1                      [b] 3                      [e] not in the list  
[c] 5                      [d] 7

**Question 2.** How many prime numbers are there between 21 and 42?

- [a] 4                      [b] 5                      [e] not in the list  
[c] 6                      [d] 7

**Question 3.** Factor 1998 into primes.

- [a]  $2^3 \cdot 3^2 \cdot 5 \cdot 7$                       [b]  $2^3 \cdot 3^2 \cdot 5^2$                       [e] not in the list  
[c]  $2 \cdot 3^4 \cdot 13$                       [d]  $2 \cdot 3^3 \cdot 37$

**Question 4.** Determine the greatest common divisor of 1017 and 1998.

- [a] 1                      [b] 2                      [e] not in the list  
[c] 9                      [d] 11

**Question 5.** Determine the least common multiple  $x$  of 21 and 87.

- [a]  $0 < x \leq 200$                       [b]  $200 < x \leq 400$                       [e] not in the list  
[c]  $400 < x \leq 600$                       [d]  $600 < x \leq 800$

**Question 6.** How many of the following equalities are correct?

$$\begin{array}{ll} 3.1459 \div 10^{-5} = 314590, & 0.0075 \times 10^3 = 75, \\ 4567 \times 10^{-6} = 0.004567, & 1986 \div 10^4 = 0.1986 \end{array}$$

- [a] 1                      [b] 2                      [e] not in the list  
[c] 3                      [d] 4

**Question 7.** Sort the following fractions in increasing order

$$\frac{17}{30}, \quad \frac{5}{8}, \quad \frac{13}{25}$$

- [a]  $\frac{13}{25} < \frac{5}{8} < \frac{17}{30}$       [b]  $\frac{17}{30} < \frac{13}{25} < \frac{5}{8}$       [e] not in the list  
 [c]  $\frac{17}{30} < \frac{5}{8} < \frac{13}{25}$       [d]  $\frac{5}{8} < \frac{13}{25} < \frac{17}{30}$

**Question 8.** Estimate  $y = 84 \times 10^{-3} + 1.6 \times 10^{-3} - 2 \times 10^{-6}$ .

- [a]  $0.016 < y < 0.084$       [b]  $9.9 \times 10^{-2} < y < 10^{-1}$       [e] not in the list  
 [c]  $10^{-1} < y < 1$       [d]  $0.084 < y < 0.087$

**Question 9.** How many of the following fractions are reduced?

$$\frac{17}{51}, \quad \frac{137}{117}, \quad \frac{93}{19}, \quad \frac{22}{27}$$

- [a] 0      [b] 1      [e] not in the list  
 [c] 2      [d] 3

**Question 10.** Evaluate  $\frac{(-35)^2}{16} \times \left(-\frac{2}{7}\right)^3$

- [a]  $-\frac{35}{16}$       [b]  $\frac{35}{16}$       [e] not in the list  
 [c]  $-\frac{25}{14}$       [d]  $-2$

**Question 11.** Simplify  $\frac{1}{3+\sqrt{6}} + \frac{\sqrt{6}}{3}$

- [a] 1      [b]  $\sqrt{6}$       [e] not in the list  
 [c]  $1 - \frac{\sqrt{6}}{3}$       [d]  $2\sqrt{3}$

**Question 12.** Simplify, eliminating radicals at denominator,  $\frac{1}{1 + \sqrt{\frac{1}{2} + \frac{2}{5}}}$

- [a]  $10 - 3\sqrt{10}$       [b] 0  
 [c]  $9 - 2\sqrt{5}$       [d]  $9 + 2\sqrt{5}$       [e] not in the list

**Question 13.** Compute the quotient of the following division

$$(x^5 + x^3 + 2x + 1) \div (x^2 - 1).$$

- [a]  $2x^3 - x$       [b]  $2x^3 + x$       [e] not in the list  
 [c]  $x^3 - 2x$       [d]  $x^3 + 2x$

**Question 14.** When  $3u^3 + v^2 - u^3v - 3v$  is factored completely, one of the factors is

- [a]  $v - u^3$       [b]  $v + 3$       [e] not in the list  
 [c]  $v - u^2$       [d]  $v + u^2$

**Question 15.** Compute the remainder of the following division

$$(y^4 + 2y^3 + 3y + 5) \div (y + 1).$$

- [a]  $y$       [b] 1      [e] not in the list  
 [c] 0      [d] 11

**Question 16.** Simplify  $\frac{1}{a^2 + 4a + 3} - \frac{1}{a + 1} - \frac{1}{a + 2}$ .

- [a]  $\frac{2a^2 + 3a - 1}{(a + 1)(a + 2)(a - 3)}$       [b]  $\frac{2a^2 - 3a + 1}{(a + 1)(a + 2)(a - 3)}$       [e] not in the list  
 [c]  $-\frac{2a^2 + 8a + 7}{(a + 1)(a + 2)(a + 3)}$       [d]  $-\frac{2a^2 + 7a + 8}{(a + 1)(a + 2)(a + 3)}$

**Question 17.** Simplify  $\frac{b^2}{b+3} - \frac{b(b+3)}{b-3}$ .

[a]  $\frac{9b(b-4)}{(b+3)(b-3)}$

[b]  $\frac{9b(b+4)}{(b+3)(b-3)}$

[e] not in the list

[c]  $\frac{9b(b+1)}{(b+3)(b-3)}$

[d]  $-\frac{9b(b+1)}{(b+3)(b-3)}$

**Question 18.** Simplify  $\left(\frac{xz^3}{-y^2}\right)^3 \left(\frac{y^3z}{-x^2}\right)^2 \left(\frac{x}{y}\right)$ .

[a]  $\frac{z^{11}}{y}$

[b]  $\frac{z^{12}}{x}$

[e] not in the list

[c]  $\frac{z^{11}y}{x}$

[d]  $\frac{z^{10}x^2}{y}$

**Question 19.** Given  $f(x) = \frac{x^2(x-2)^2}{(x-1)^4}$ , simplify  $f(\sqrt{y}+1)$  where  $y > 0$ .

[a]  $\frac{(y-1)^2}{y^2}$

[b]  $\frac{(\sqrt{y}-1)^2}{y^2}$

[e] not in the list

[c]  $\frac{y^2-1}{(\sqrt{y}+1)^4}$

[d] 0

**Question 20.** Simplify  $\left(\frac{(a-b)^2(a+b) - a^3 + b^2a + a^2b}{b^2}\right)^2$ .

[a]  $\frac{a^6 - a^4b^2 - 2ab^4 + 2ab^2}{b^4}$

[b]  $a^4b^2 + b^4 + a^2$

[e] not in the list

[c]  $\frac{a^6 + a^4b^2 - 2ab^4 + 2ab^2}{b^4}$

[d]  $b^2$

**Question 21.** Solve the simultaneous equations  $3x + y = 4$ ,  $2x - y = 5$ .

[a]  $x = 2$ ,  $y = -\frac{7}{5}$

[b]  $x = \frac{11}{5}$ ,  $y = \frac{1}{5}$

[e] not in the list

[c]  $x = \frac{9}{5}$ ,  $y = -\frac{7}{5}$

[d]  $x = \frac{9}{5}$ ,  $y = -2$

**Question 22.** Solve the equation  $\frac{2}{5} - \frac{\sqrt{x}}{2} = \frac{1 - \sqrt{x}}{3}$ .

[a]  $\frac{4}{25}$

[b]  $\frac{2}{5}$

[e] not in the list

[c]  $\frac{1}{9}$

[d]  $\frac{7}{30}$

**Question 23.** Solve the inequality  $-\frac{3u-1}{5} < -\frac{5u-1}{3}$ .

[a]  $u < \frac{1}{15}$

[b]  $u > \frac{1}{15}$

[e] not in the list

[c]  $u < \frac{1}{8}$

[d]  $u > \frac{1}{8}$

**Question 24.** Solve the simultaneous equations  $\frac{x}{\sqrt{2}} + \frac{y}{\sqrt{3}} = 1$ ,  $x + y\sqrt{6} = 0$ .

[a]  $x = \sqrt{6}$ ,  $y = -2\sqrt{3}$

[b]  $x = \frac{3}{\sqrt{2}}$ ,  $y = -\frac{\sqrt{3}}{2}$

[e] not in the list

[c]  $x = \sqrt{6}$ ,  $y = 2\sqrt{3}$

[d]  $x = \frac{3}{\sqrt{2}}$ ,  $y = \frac{\sqrt{3}}{2}$

**Question 25.** Solve the equation  $(x-5)^2 - 2 = x$ .

[a]  $x = \frac{1}{2} (13 \pm \sqrt{31})$

[b]  $x = 1, 3$

[e] not in the list

[c]  $x = \frac{1}{2} (11 \pm \sqrt{29})$

[d]  $x = -\frac{1}{3}, \frac{2}{5}$

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**End of Paper.**

**Solutions**

1. c
2. b
3. d
4. c
5. d
6. c
7. e
8. d
9. d
10. c
11. a
12. a
13. d
14. a
15. b
16. c
17. d
18. e
19. a
20. d
21. c
22. a
23. c
24. b
25. c