INTERMEDIATE CERTIFICATE EXAMINATION, 1981

MATHEMATICS - HIGHER COURSE - PAPER II (300 marks)

SECTION A (100 marks)

1. $120_3 \div 12_3$ is

☐ (a) 10_{ten} (b) 10_3 (c) 101_3 (d) 133_3

2. $\frac{5}{12}$ of a sum of money is IR£60. The sum of money in IR£ is

☐ (a) 25 (b) 144 (c) $\frac{300}{12}$ (d) 168

3. If $p : q = 3 : 7$ and $q : r = 3 : 7$, then $p : r$ is

☐ (a) 3 : 7 (b) 9 : 21 (c) 9 : 49 (d) 21 : 49

4. $(0{\cdot}4)^2$ lies between

☐ (a) 0·4 and 1 (b) 0·2 and 1 (c) 0·1 and 0·2 (d) 0 and 0·1

5. If the radius of a sphere is doubled, then the volume of the sphere is increased x times. x is

☐ (a) 2 (b) 4 (c) 6 (d) 8

6. $(1 + \frac{r}{100})^2 = 1{\cdot}44$. Then r is

☐ (a) 20 (b) 2 (c) 200 (d) 0·2

7. Each term of a sequence is to be an odd number. The nth term is

☐ (a) $n + 1$ (b) $3n$ (c) $3n + 1$ (d) $2n + 1$

8. If # A is 7 and # B is 5, where A, B are sets, then # $(A \cap B)$ can <u>not</u> be

(a) 0 (b) 3 (c) 5 (d) 7

9. Which of the following is not a function ?

(a) $\{(p, p), (q, q), (r, r)\}$ (b) $\{(p, q), (q, q), (r, q)\}$

(c) $\{(p, p), (q, r), (r, p)\}$ (d) $\{(p, p), (p, q), (p, r)\}$

10. The set of values of x for which $(3x + 2)(3 - 2x) = 0$ is

(a) $\{-1\frac{1}{2}, -\frac{2}{3}\}$ (b) $\{1\frac{1}{2}, -\frac{2}{3}\}$ (c) $\{1\frac{1}{2}, \frac{2}{3}\}$ (d) $\{-1\frac{1}{2}, \frac{2}{3}\}$

11. $8^{1\frac{1}{3}}$ is

(a) 16 (b) 10 (c) 2 (d) $\frac{64}{3}$

12. $\log_x p^{\frac{3}{2}} = 3$. Then x is

(a) $p^{\frac{1}{2}}$ (b) $p^{-\frac{3}{2}}$ (c) $p^{\frac{9}{2}}$ (d) p^{18}

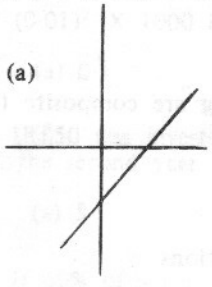
13. Two taps together fill a bath in 9 minutes. One tap flows twice as fast as the other. The slower tap alone would fill the bath in y minutes. y is

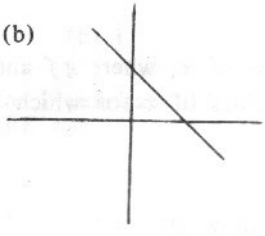
(a) 12 (b) 18 (c) 27 (d) 3

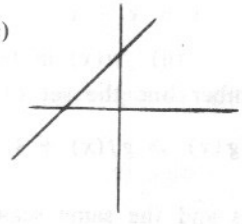
14. $(x^6 - 1) \div (x^2 - 1)$ is

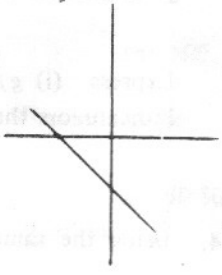
(a) $x^3 + 1$ (b) $x^3 - 1$ (c) $x^4 - x^2 + 1$ (d) $x^4 + x^2 + 1$

15. If $f : x \to x - 2$ then a sketch of f^{-1} is

(a) 

(b) 

(c) 

(d) 

16. If $A \cup B = \{1, 2\}$ and $B \cup C = \{2, 3\}$, then $A \cap B \cap C$ can be

(a) $\{2\}$ (b) $\{2, 3\}$ (c) $\{1, 2, 3\}$ (d) $\{1\}$

17. If $f(x^2 + 7) = 2x^2 + 7$, then f is $x \to$

(a) $2x - 7$ (b) $2x^2$ (c) $2x^2 + 7$ (d) $x + 7$

18. If $w = \frac{t - 2v}{7}$, then v is

(a) $7w - t$ (b) $\frac{t - 7w}{2}$ (c) $\frac{7w - t}{2}$ (d) $\frac{7w}{t - 2}$

19. The range of values of x for which $(x - 1)(x + 2) < 0$ is

(a) $-2 \leqslant x \leqslant 1$ (b) $x < -2$ and $x > 1$

(c) $-2 \leqslant x < 1$ (d) $-2 < x < 1$

20. Let $u * v = (u + v)(u - v)$. Then $u * v = 0$ always implies

(a) $u + v = u - v$ (b) $u = 0$ and $v = 0$

(c) $u = 0$ or $v = 0$ (d) $u = v$ or $u = -v$.

INTERMEDIATE CERTIFICATE EXAMINATION, 1981

MATHEMATICS - HIGHER COURSE - PAPER II

SECTION B (200 marks)

1. (a) The water surface in a canal lock is 21 m in length and 10 m in width. The level of water is raised 3·5 m in ten minutes by a flow of water into the lock. Calculate the rate of flow in litres per second.

   (b) Using tables, P.20 - P.27, or otherwise, evaluate as accurately as the tables allow

   $$\sqrt{\frac{1}{t} + \sqrt{u} + w^2}$$

   where $t = 0{\cdot}2959$, $u = 841$ and $w = 6{\cdot}856$.

2. (a) Factorise (i) $x^2 - 49$
   (ii) $8x^3 - 27$
   (iii) $6x^2 - 29x + 28$.

   (b) Evaluate x in each of the following, giving your answers correct to one place of decimals
   (i) $3x^2 + x - 1 = 0$
   (ii) $3(x + 1)^2 + x = 0$.

3. f is a function defined on $\mathbf{R}$:

   $$f : x \to ax^2 + bx + c .$$

   If $f(0) = 1$, find the value of c.

   If $f(1) = 0$ and $f(-1) = 0$, find the value of a and the value of b.

   g is another function defined on $\mathbf{R}$:

   $$g : x \to x - 1.$$

   Express (i) $gf(x)$ (ii) $fg(x)$ in terms of x, where gf and fg are composite functions.
   Indicate on the number line the set of values of x for which

   $$fg(x) \geqslant gf(x) + 3.$$

4. Using the same axis and the same scales draw graphs of the functions
   (i) $f : x \to 4x^2 + 8x - 5$
   (ii) $g : x \to 2x + 5$

   in the domain $-3 \leqslant x \leqslant 1$, $x \in \mathbf{R}$.

   Using the graphs, or otherwise, estimate
   (i) the values of x for which $f(x) - g(x) = 0$
   (ii) the range of values of $x > -2$ for which $f(x) + g(x) > 0$
   (iii) the maximum value of $f(x) + g(x)$.

5. (a) Find the solution set of

   $$\frac{1}{x + 1} - \frac{3}{x^2 + 3x + 2} = \frac{1}{2x(x + 1)}, \quad x \in \mathbf{R} .$$

   (b) Let $p = \log_{10} 3$ and $q = \log_{10} 2$.

   Express (i) $p + q$ and $p - q$ in the form $\log_{10} n$.

   Express (ii) $(\log_{10} 16 + \log_{10} 15)$ and $\log_5 6$ in terms of p and q .

6.

6. The number of cars rented out in each of nine months by a firm is:

Jan.	Feb.	March	April	May	June	July	Aug.	Sep.
30	26	34	30	53	61	81	89	46

(i) Calculate the mean number of cars rented out per month.

(ii) Draw a trend graph of the monthly rentals, taking the months along the horizontal axis.

(iii) Calculate the difference between the rentals in each month and the mean. Find the sum of these differences.

(iv) After how many months was half the nine month total of rentals completed ?

(v) On the same graph as (ii) draw the graph of the three point moving average of the monthly sales.

7. Write an equation expressing distance in terms of speed and time.

A cyclist races a measured distance downhill in 40 seconds and the same measured distance uphill in 120 seconds.

If the speed uphill is 19 km/hr slower than the speed downhill, calculate both speeds.