# MATHS

# BOOKS - UNITED BOOK HOUSE

# THE SCOTTISH CHURCH COLLEGIATE SCHOOL

## Exercise

**1.** If $a \in N$ and $aN = \{ax : x \in N\}$then the value of $3N \cap 5N$is

A. a)2N

B. b)8N

C. c)15N

D. d)30N

**Answer:**

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**2.** If f(x+1)=3x-9,then value of $f\left(x^2-1\right)$ is

A. a)$3x^2-9$

B. b)$3x^2 - 15$

C. c)$x^2 - 10$

D. d)$3x^2 - 10$

**Answer:**

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**3.** In a GP the sum of first 6 terms is 9 times the sum of first 3 terms.The common ratio is

A. a)2

B. b)4

C. c)14

D. d)30

**Answer:**

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**4.** If $x = \sin^2\alpha + \cos ec^2\alpha$,then the value of x is

A. a)$0 < x \leq 1$

B. b)$1 \leq x < 2$

C. c)$x \geq 2$

D. d)x=1.5

**Answer:**

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**5.** The centre of the circle $\lambda x^2 + (2\lambda - 3)y^2 - 4x + 6y - 1 = 0$is

A. a)(2/3,-1)

B. b)(4/3,-1)

C. c)(-2/3,1)

D. d)(2/3,1)

**Answer:**

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**6.** The condition that the points (a,0),(0,b)and (2,2) are collinear is

A. a)a+b=2

B. b) $\frac{1}{a}+\frac{1}{b}=\frac{1}{2}$

C. c) $\frac{1}{a}+\frac{1}{b}=1$

D. d) $\frac{1}{a}+\frac{1}{b}=2$

**Answer:**

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**7.** Which one is the equation of the directrix of the parabola $3y^2 = -4x$

A. a)3y-1=0

B. b)3x-1=0

C. c)3y+1=0

D. d)3x+1=0

**Answer:**

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**8.** The value of $\lim_{x \to 0} \frac{1 - \cos 4x}{x^2}$ is

A. a)8

B. b)4

C. c)1/2

D. d)1/4

**Answer:**

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**9.** If $y = \cos^2\left(\frac{x}{2}\right)$ then $\frac{dy}{dx}$ is

A. a) $\cos x$

B. b) $\frac{1}{2}\cos x$

C. c) $-\frac{1}{2}\sin x$

D. d) $-\sin x$

**Answer:**

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**10.** In the expansion of $(1+x)^{m+n}$ the co-efficient of $x^m$ is

A. a) $\frac{m!n!}{m+n}$

B. b) $(m+n)!$

C. c) $\frac{(m+n)!}{m!n!}$

D. d) none of these

**Answer:**

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**11.** if $g(x) = \frac{x-a}{x} + \frac{x}{x-b}$ then show that $g\left(\frac{a+b}{2}\right) = \frac{4ab}{a^2-b^2}$

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**12.** Find the domain of definition of the function

$$f(x) = \frac{1}{\sqrt{5x - x^2 - 6}}$$

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**13.** If $\tan\left(\frac{\pi}{4}-\theta\right)=\frac{1}{2}$ then find $\sin 2\theta$

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**14.** Prove that $2\sin\left(\frac{\pi}{8}\right)=\sqrt{2-\sqrt{2}}$

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**15.** If Z is a complex number $|Z+3|\leq 5$.then find the greatest and smallest value of |Z+1|.

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**16.** Find the value of n so that $\frac{a^{n+1}+b^{n+1}}{a^n+b^n}$ may be the geometric mean between a and b.

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**17.** In the expansion of $\left(x^2+\frac{K}{x}\right)^6$ the co-efficient of $x^3$ is 160.what is the value of K?

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**18.** If $\left(2^{2n}-1\right)$ is division by 3,then show that $\left[2^{2(n+1)}-1\right]$ is also divisible by 3.

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**19.** Find the equation of the st.line which pass through the pt(3,1) and perpendciular to the line joining (-1,1)and (0,-1).

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**20.** Show that the locus of the pt of intersection of the st.lines $x\cos\theta + y\sin\theta = a$and $x\sin\theta - y\cos\theta = b$is a circle.

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**21.** Find the focus of the parabola $y = x^2 + x + 1.$

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**22.** Prove that the derivative of an odd function an ever function .

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**23.** Evaluate : $\lim_{x \to y} \frac{\cos^2 x - \cos^2 y}{x^2 - y^2}$

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**24.** If y = $\sqrt{x + \sqrt{x + \sqrt{x + \cdots \infty}}}$ then $\frac{dy}{dx} =$

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**25.** Prove that

$$A \times (B \cup C) = (A \times B) \cup (A \times C)$$

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**26.** If $\cos\theta = \dfrac{a\cos\phi + b}{a + b\cos\phi}(\theta, \phi acute\angle)$ show that $\tan\left(\dfrac{\theta}{2}\right) = \sqrt{\dfrac{a-b}{a+b}}\tan\left(\dfrac{\phi}{2}\right)(a > b)$

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**27.** If $\frac{\tan 3\alpha}{\tan \alpha} = \lambda$,show that $\frac{\sin 3\alpha}{\sin \alpha} = \frac{2\lambda}{\lambda - 1}$ and hence prove that the value of $\lambda$does not lie between 1/3 and 3

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**28.** For all $n \geq 1$ prove that

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots . + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

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**29.** Show that 1 is a root of $a(b-c)x^2+b(c-a)x+c(a-b)=0$.Hence show that if roots of this equation are equal then 1/a,1/b,1/c are in A.P.

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**30.** Find the sum to n terms : $\frac{1}{2}+\frac{3}{2^2}+\frac{5}{2^3}+\ldots+\frac{2n-1}{2^n}$

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**31.** Find the term inedpendent of X in the expansion of $(1+x)^3\left(1-\frac{1}{x}\right)^6$

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**32.** A moving st.line always passes through a fixed pt.$(\alpha, \beta)$.Prove that the locus of the middle point of the portion of the line intercepted between the axes is $\frac{\alpha}{x}+\frac{\beta}{y}=2$

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**33.** Find the image of the pt.(-3,-1)with respect to the st.line 2x+3y+22=0

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**34.** Find equations of all possible circles that touch the y axis at the point(0,3)and cut the chord of length 8 units from the x axis .

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**35.** Find the equation of the circles which touche the y axes id and passes through the pts(-2,1)and (-4,3).

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**36.** Show that $\lim_{x \to 1} (1-x)\tan\left(\frac{\pi x}{2}\right) = \frac{2}{\pi}$

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**37.** If 2f(x)+3f(-x)=$x^2 - x - 1$,then find f'(1).

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**38.** Find from the first principle,the derivative of tan 2x at $x = \frac{\pi}{8}$

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**39.** If f(x) is differentiable at x=a then show that $\lim_{x \to 0} \frac{x^2 f(a) - a^2 f(x)}{x - a} = 2af(a) - a^2 f^1(a)$

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**40.** Prove the following by contradiciton ."The sum of a rational and an irrational number is an irrational number?".

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**41.** Let a statement $p$: $\triangle ABC$is right angle triangle,and another statement q:in a $\triangle ABC, AB^2 + BC^2 = AC^2$check whether the following statemnets are true or false b) q implies p

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**43.** Let a statement $p$: $\triangle ABC$is right angle triangle,and another statement q:in a $\triangle ABC, AB^2 + BC^2 = AC^2$check whether

the following statemnets are true or false c) p is true if and only if q is true

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**44.** Let a statement $p$: $\triangle ABC$is right angle triangle,and another statement q:in a $\triangle ABC, AB^2 + BC^2 = AC^2$check whether the following statemnets are true or false d)-p implis-q(-p denotes the negation of the statement p).

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**45.** Find the range of the function

$$f(x) = \frac{1}{3\sin x + 4\cos x + 6}$$

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**46.** Prove that

$$\cos^2\alpha + \cos^2(120^\circ - \alpha) + \cos^2(120^\circ + \alpha) = \frac{3}{2}$$

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**47.** Let $f(x) = \frac{4^x}{4^x + 2}$ prove.that f(x) + f(1- x)= 1.

Hence prove that

$$f\left(\frac{1}{1997}\right) + f\left(\frac{2}{1997}\right) + .... + f\left(\frac{1996}{1997}\right) = 998$$

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**48.** If $x + iy = \frac{3}{2 + \cos\theta + i\sin\theta}$ then show that $x^2 + y^2 = 4x - 3.$

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**49.** If S be the sum. P be the product,and R the sum of the reciprocals of n terms in a G.P., Prove that $P^2 = \left(\frac{S}{R}\right)^n$

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**50.** If the equation $x^2 + px + qr = 0$ and $x^2 + qx + pr = 0 (p \neq q, r \neq 0)$ has same root then prove that p+q+r=0

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**51.** If n>1 be a +ve integer,then using binomial theorm show that $\left(4^{2n+2}-15n-16\right)$ is always divisible by 225.

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**52.** The equation of the axis and directrix of a parabola are $y-3=0$ and $x+3=0$ respectively and the length of the latus tectum is 8 units.find the equation of the parabola and the coordinates of its verex.

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**53.** If l and l' be the lengths of the segment $\overline{PS}$ and $\overline{P'S}$ of a focal chord $\overline{PP'}$ of the parabola $y^2 = 4ax$.then show that1/l+1/l'=1/a when s is the focus of the parabola

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