# RIGOUR

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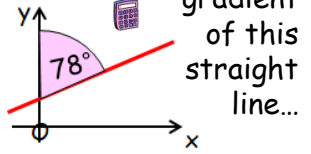
Numeracy for Learning, Life and Work


# January Higher Maths Calendar

## #abitofmathseveryday


**1** Calculate the gradient of this straight line...




**2** If $x$ is an acute angle with $\sin x = \frac{5}{13}$ find the exact value of $\sin 2x$.

**3** Find the equation of the tangent at the point (9, 1) on the circle

$x^2 + y^2 - 12x + 4y - 6 = 0$

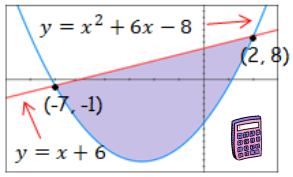
**4** A sequence is defined by the recurrence relation

$u_{n+1} = 0{\cdot}5u_n - 3$, $u_0 = 4$

What is the value of $u_2$?

**5** Find the equation of the tangent to the curve $y = x^3 - 2x^2 + 8x$ at the point where $x = 1$.

**6** Calculate the shaded area...




**7** Find the coordinates of the stationary points on the curve $y = x^3 + 9x^2 + 24x - 3$ and determine their nature.

**8** Calculate the size of the angle between vectors

$\underline{p} = \begin{pmatrix} 5 \\ 0 \\ 2 \end{pmatrix}$ & $\underline{q} = \begin{pmatrix} -1 \\ 3 \\ 4 \end{pmatrix}$.

**9** Solve this quadratic inequality;

$x^2 - 2x - 80 > 0$

**10** Calculate the length of the line joining (-4, -9) and (1, 3).

**11** Differentiate

$5\cos^2 x$

**12** Solve the following logarithmic equation;

$\log_{36}(x - 4) = \frac{1}{2}$

**13** Find the point of intersection between the following straight lines...

$y = 7 - x$

$y = 2x + 1$

**14** A sequence is defined by the recurrence relation

$u_{n+1} = \frac{3}{7}u_n - 4$, $u_0 = -14$

Calculate the limit where $n \to \infty$

**15** $f'(x) = 4x^3 + 9$ passes through the point (1, 6).

Find f(x).

**16** If $A$ and $B$ are acute angles with $\sin A = \frac{1}{3}$ and $\cos B = \frac{3}{7}$ find the exact value of $\sin(A + B)$.

**17** Express $5\cos x° - 2\sin x°$ in the form $k\cos(x + a)°$ where $k > 0$ and $0 < a < 360$.

**18** Find the equation of the straight line which is perpendicular to the line with equation $x + 2y = 8$ and which passes through the point $(-1, 3)$.

**19** Write

$y = -3x^2 - 12x + 5$

in the form

$y = a(x + b)^2 + c$.

**20** Evaluate;

$$\int (5x + 1)^3 \, dx$$

**21** Show the circles

$(x + 3)^2 + (y + 1)^2 = 4$

and

$(x - 5)^2 + (y - 5)^2 = 49$

do not intersect.

**22** Triangle DEF has vertices D(-3, -4), E(3, 4) and F(5, 0). Calculate the equation of the median from E.

**23** Solve the equation

$\cos 2x° = 3\cos x° - 2$

$0 \leq x < 360°$

**24** Show that R(-2, -1, 0), S(3, 9, -15) and T(9, 21, -33) are collinear and find the ratio in which S divides RT.

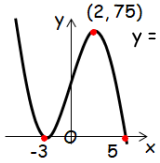
**25** Fully factorise the polynomial

$g(x) = x^3 - 52x + 96$.

**26** A line has a midpoint of (1, 4). One of the end points on the line is (-1, -7). What are the coordinates of the other end point?

**27** If $P_t = P_0 e^{-0{\cdot}009t}$, where $t$ is the time taken, calculate the half life.

**28** This function has an equation of the form $y = k(x + a)(x + b)^2$.




Determine the equation of the graph.

**29** Show that the line $y = x - 2$ does not intersect the curve $y = x^2 - 3x + 8$.

**30** A sequence is defined by the recurrence relation

$u_{n+1} = au_n + b$, $u_0 = 1$

If $u_1 = 9$ and $u_2 = 41$, find the values of a & b.

**31** A function is given by $f(x) = 2x - 7$.

Find the inverse function $f^{-1}(x)$.