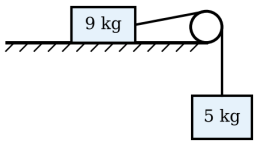
Day 271 **A Level Maths: B Tier 10-a-day**

1 The line l has equation $y = -\frac{1}{2}x + 3$. The point P is (0, 8).
(a) Find the line through P perpendicular to l, as $ax + by + c = 0$ with integer a, b, c.
(b) Find the foot F and the exact distance PF.

2 A block of mass 9 kg lies on a rough horizontal table (coefficient of friction 0.2). It is joined by a light string over a smooth pulley to a particle of mass 5 kg hanging freely.
Take $g = 9.8$ m s^{-2}.
The system is released. Find the acceleration and the tension in the string.



3 7 values of x are coded using $y = \frac{(x - 20)}{2}$.
$\Sigma y = 5$ and $\Sigma y^2 = 109$.
Find the mean and standard deviation of x (3 s.f.).

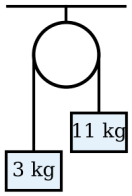
4 The vector $\mathbf{a} = \begin{pmatrix} 10 \\ 2 \\ -11 \end{pmatrix}$.
Find $|\mathbf{a}|$ and a unit vector in the direction of a.

5 Solve $|3x - 6| = -4x - 6$.

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6 Given that $y = \ln(4x^2 + 7)$,
find $\frac{dy}{dx}$, and the gradient of the curve when $x = 1$.

7 Particles of mass 3 kg and 11 kg hang on a light string over a smooth fixed pulley, as shown, and are released from rest. Take $g = 9.8$ m s^{-2}.
Find the acceleration and the tension in the string.



8 The variables x and y satisfy $y = Ae^{kx}$. A graph of ln y against x is a straight line through (0, 2) and (4, 3.6).
Find A to 3 s.f. and k.

9 The line $5x - 12y = k$ is a tangent to the circle $(x - 4)^2 + y^2 = 169$.
Find the two possible values of k.

10 For 8 pairs of values, $\bar{x} = 6$, $\bar{y} = 40$, $S_{xx} = 100$ and $S_{xy} = 250$.
(a) Find the regression line of y on x in the form $y = a + bx$.
(b) Estimate y when $x = 3$.