AQA Level 2 Further Mathematics Warmup - Paper 2 2024

What is the gradient and $y-$intercept of the straight line $3x - 2y = -7$

Expand $(3 + 2x)^4$ using the binomial expansion.

Solve $\tan^2(x) = \sqrt{3}\tan(x)$

Rearrange $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ to make f the subject.

Factorise $(x-3)^2(x+4) + 4(x-3)^3$

Find the rate of change of $y = 3x^3 - 2x^2$ when $x = 2$

Solve

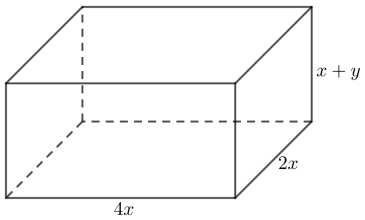
$$2x + y + 3z = 8$$
$$x + y + 4z = 15$$
$$2x - y + 5z = 12$$

Find the rate of change of $y = (2x+1)^2(x+3)$ when $x = 2$

The point $C\left(-\frac{5}{2}, 0\right)$ is the midpoint of AB where $A(-5, -3)$ and $B(2, a)$. Find a.

The matrix M represents a rotation by $180°$ followed by reflection in the line $y = x$. What is M?

Consider the cuboid shown below.



The total length of the 12 edges is 200 cm.

a) Show that $y = 50 - 7x$

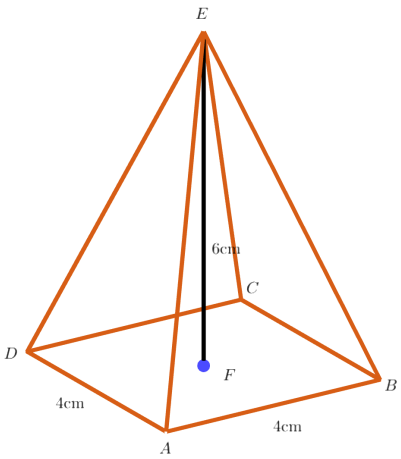
b) The volume of the cuboid is V, show that $V = 400x^2 - 48x^3$

c) Use calculus to work out the maximum value of V as x varies.

Find the tangent to $y = 2x^3 + 3x$ at $x = 1$

Sketch the graph of $y = 4 \times 3^x$

In the square based pyramid below the base has side lengths 4cm and the perpendicular height is 6cm. F is directly below E. Find the angle AE makes with the downward vertical EF



The coefficient of x^2 in the expansion of $(3x + a)^5$ is 720. Find a.

Three points are plotted in the plane with coordinates, $A(1,10)$, $B(2,3)$ and $C(5,7)$. Show that ABC is a right angled triangle.

Find the equation of the tangent to the circle $x^2 - 6x + y^2 - 4y = 0$ at the point $(5,5)$.
Find also where this tangent intersects the $x-$ axis.

The nth term of a quadratic sequence is $n^2 + 4n$.find which two consecutive terms have a sum of 213.

How many odd numbers can you make with the digits 2,3,4 and 5 with no repetition?

Sketch $f(x) = x^2 - 3, \quad x \geq 0$ and its inverse on the same graph

The destination tower of a cable car is 169m above the base tower. The towers are 632 m apart. Find the angle of elevation.

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Gradient $= \frac{3}{2}$

$y-$intercept $= \frac{7}{2}$

$(3+2x)^4 = 1\times 3^4\times(2x)^0 + 4\times 3^3\times(2x)^1$
$+ 6\times 3^2\times(2x)^2 + 4\times 3^1\times(2x)^3$
$+ 1\times 3^0\times(2x)^4$
$= 81 + 216x + 216x^2 + 96x^3 + 16x^4$

$\tan^2(x) = \sqrt{3}\tan(x)$
$\tan^2(x) - \sqrt{3}\tan(x) = 0$ so
$\tan(x)\left(\tan(x) - \sqrt{3}\right) = 0$
$\tan(x) = 0 \Rightarrow x = 0°, 180°$ and
$\tan(x) = \sqrt{3} \Rightarrow x = 60°, 240°$

$\frac{u-v}{uv} = \frac{1}{f}$ and so
$f = \frac{uv}{u-v}$

$(x-3)^2(5x-8)$

$\frac{dy}{dx} = 9x^2 - 4x$
When $x = 2$, $\frac{dy}{dx} = 28$

$x = -3$
$y = 2$
$z = 4$

$(2x+1)^2(x+3) = 4x^3 + 16x^2 + 13x + 3$
$\frac{dy}{dx} = 12x^2 + 32x + 13$
when $x = 2$, $\frac{dy}{dx} = 125$

$a = 3$

$\begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}\begin{pmatrix}-1 & 0\\ 0 & -1\end{pmatrix} = \begin{pmatrix}0 & -1\\ -1 & 0\end{pmatrix}$

$4\times 4x + 4\times 2x + 4\times(x+y) = 200$
$28x + 4y = 200$
So $y = \frac{200-28x}{4}$
$= 50 - 7x$

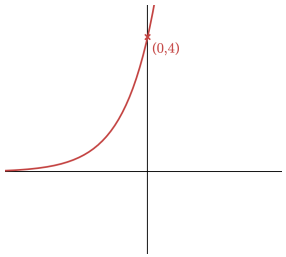
$V = 4x\times 2x\times(x+50-7x)$
$= 4x\times 2x\times(50-6x)$
$= 8x^2(50-6x)$
$= 400x^2 - 48x^3$

$\frac{dV}{dx} = 800x - 144x^2$
At a maximum $\frac{dV}{dx} = 0$ and so
$16x(50-9x) = 0$. Maximum occurs at
$x = \frac{50}{9}$ where $V \approx 4115.2\text{cm}^2$

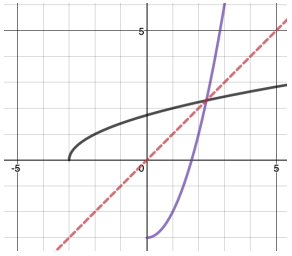
$\frac{dy}{dx} = 6x^2 + 3$. At $x = 1$,
$\frac{dy}{dx} = 9$, so equation of tangent is of the form $y = 9x + c$ and passing through $(1,5)$. Hence, the equation is $y = 9x - 4$

$|AB| = \sqrt{(2-1)^2 + (3-10)^2} = \sqrt{50} = 5\sqrt{2}$
$|BC| = \sqrt{(5-2)^2 + (7-3)^2} = \sqrt{25} = 5$
$|CA| = \sqrt{(5-1)^2 + (7-10)^2} = \sqrt{25} = 5$
Hence, $|AB|^2 = |BC|^2 + |CA|^2$ and so Pythagoras' Theorem holds, and hence ABC is right angled.

$3\times 2\times 2 = 12$



Circle has centre $(3,2)$ and radius $\sqrt{13}$.
Equation of tangent at $(5,5)$ is $2x + 3y = 25$.
The tangent meets the $x-$axis at $(12.5,0)$.



Let M be the midpoint on side AB. Consider the triangle AMF then $|AM| = 2$ and $|MF| = 2$. By Pythagoras $|AF| = \sqrt{4+4} = \sqrt{8}$

Now consider triangle AFE, then the angle we seek is the angle at Vertex E. $|AF| = \sqrt{8}$ and $|EF| = 6$ so
$\tan(\theta) = \frac{\sqrt{8}}{6}$ and
$\theta = 25.23°$

$10\times(3x)^2\times a^3 = 720$
$a^3 = \frac{720}{10\times 9}$
$a^3 = 8$
$a = 2$

$n^2 + 4n + (n+1)^2 + 4(n+1) = 213$
and so $2n^2 + 10n + 5 = 213$.
Solving $2n^2 + 10n - 208 = 0$
gives $n = 8$ and so
Terms 8 and 9.

14.97°