X1 - 3 Year 12 - Ext 1 - Trial and HSC Revision - Sheet 3

Name:

Question 1 {Perms and Combs}

To complete a course, a student must choose and pass exactly three topics. **2**

There are eight topics from which to choose.

Last year 400 students completed the course.

Explain, using the pigeonhole principle, why at least eight students passed exactly the same three topics.

Hint: Given you have to pass 3 out of 8 topics, how many ways are there to pass the course?

Question 2 {inequalities} $f(x) = (x+5)\big(x^2+6x+5\big)$. By finding the roots or otherwise, solve the inequality $f(x) \geq 0$

Question 3 {further trig} - solve $4\sin\theta\cos\theta = -2$. HINT: divide by 2 first.

Question 4 {further logs and exponents}

4 A chemical reaction causes the amount of chlorine to be reduced at a rate proportional to the amount of chlorine present at any one time. If the amount of chlorine is given by the formula $A = A_0 e^{-kt}$ and 100 L reduces to 65 L after 5 minutes, find:

a the amount of chlorine after 12 minutes

b how long it will take for the chlorine to reduce to 10 L.

Question 5 {further logs and exponents}

At time t the displacement, x, of a particle satisfies $t = 4 - e^{-2x}$. **3**

Find the acceleration of the particle as a function of x.

Question 6 {vectors}

A projectile is launched from a height of 20m, at an angle of 45^o and with an initial velocity of $30\,ms^{-1}$. Find the horizontal range of the projectile.

Question 7 {further vectors}

Given $\vec{u} = 3_i + 7_j$ and $\vec{v} = 2_i + 3_j$, find $proj_{\vec{u}}\vec{v}$

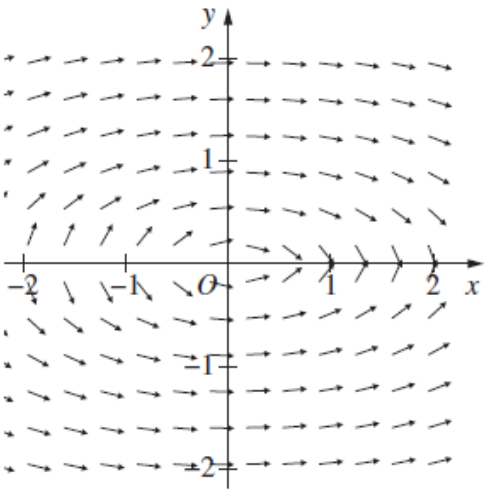
Question 8 {trig equations}

Write $\sqrt{3}\sin x + \cos x$ in the form $R\sin(x+\alpha)$ where $R > 0$ and $0 \le \alpha \le \frac{\pi}{2}$. **2**

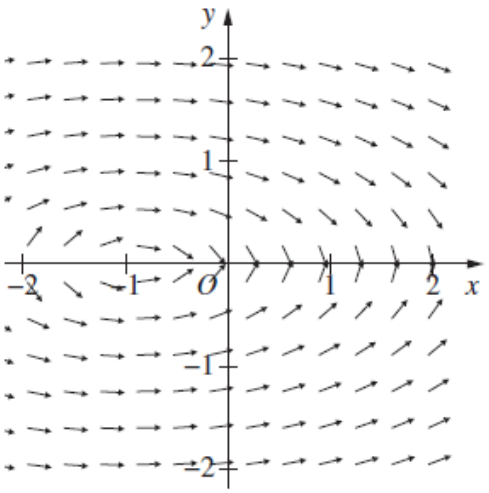
Question 9 {differential equations}

7 Which of the following best represents the direction field for the differential equation $\frac{dy}{dx} = -\frac{x}{4y}$?

A.



B.



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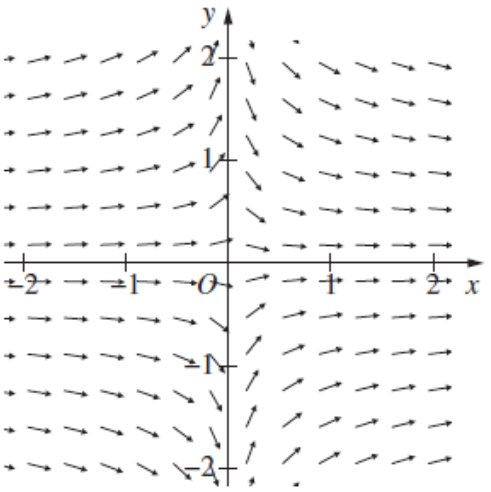

D.