UNIVERSITY OF BIRMINGHAM

Feedback Guidance

Designed by students to benefit students

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The purpose of this guide is to offer tips and advice on how to use the feedback you receive from lecturers to the best effect. It will allow you to know what you can expect from feedback provided by lecturers.

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1. Feedback Summary
    - A summary of what you can expect from feedback as a student.
2. Activity
    - Designed to work alongside personal tutor sessions to help improve your mathematical writing ability and exam technique.
3. Questions
    - Binomial Expansion (A level paper)
    - Proof by Induction (Past additional exercise)
    - Basic Mechanics (Past homework)
    - Statistics (Past homework)
    - Differentiation (A level paper)
    - Integration (A level paper)
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    - Section B Exam Question
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Feedback Summary

Feedback is when a student receives comments on their current performance and advice on how to improve/develop their work. This can be delivered formally as written comments, or informally during personal tutor sessions.

Every lecturer and post-grad has received training on how to provide good and effective feedback. They will strive to be prompt with their delivery of feedback, offer guidance and encouragement, and be clear in what they say/write.

Examine the feedback you receive immediately. Use feedback to help you learn. Feedback is designed to help you prepare for the next section of teaching material. The sooner feedback is used; the easier it is to comprehend. However, if you are still stuck, ask for help.

Don't ignore feedback. Feedback should be your first point of call when starting revision, as it highlights key areas/topics that you can improve on. When revising, if you still don't understand the feedback you have received, ask for clarification.

Before you look at solutions, always attempt the questions. As tempting as it is, when you are struggling with a question, not attempting it first is counter-productive as you won't know which parts you don't understand and need to revise.

Attain ideas for revision techniques from your peers and lecturers. Students will be the best at telling you which topics are difficult so may require more focus. Office hours are a great time to go and ask for additional help if you hit a bump during revision.

Can't remember that proof? Don't panic. Memorising proofs is not an effective way of learning. Try to develop an understanding of how different proofs are formed. This will allow you to write clearer arguments under pressure in an exam.

Killer questions should always be re-attempted closer to exams. These will be the questions that cover multiple parts of a topic so you will revise multiple areas by re-attempting them. Re-marking them will reveal if you have made improvements.

Activity

The purpose of this activity is to allow you to see the process lecturers and post-grads go through when marking your work. This will, hopefully, give you a better understanding of lecturer expectations and will allow you to improve your work and understand the feedback you receive on it.

The examples of students work are designed to get you thinking about your presentation skills and emphasise the importance of good presentation. Remember, good presentation refers to the lay-out and fluency with which your answer can be read. It is not a reflection of your handwriting ability.

Have an attempt at answering each question. Then check your answer against the model solutions and mark schemes. What can you do to bring your answer in line with the lecturers' expectations?

The following questions will be of varying levels of difficulty. Some of them will be from recent A level papers, and some will be from recent past homework tasks. A few will be from recent final exams and these questions are mainly for use by second year students.

- Questions 1, 5, 6 & 7 are from A level exam papers.
- Questions 2, 3, 4 & 8 are from past homework exercises/additional exercises.
- Question 9 & 10 are from past final exam papers.

Compare questions 7 & 8; they are both on vectors. Question 7 was found at the end of an A level paper; whereas, 8a is considered a quick one mark question and 8b is the first part of an additional exercise. This demonstrates the difference between university and A level style questions. Working through both questions is a good way of understanding the difference in expectations at university.

1. Given

$$f(x) = (2 + 3x)^{-3}, \qquad |x| < \frac{2}{3}$$

Find the binomial expansion of $f(x)$,in ascending powers of x, up to and including the term in x^3.

Give each coefficient as a simplified fraction.

[5]

2. Use the Principle of Mathematical Induction to show:

$$\left(\bigcup_{k=1}^{n} A_k\right)' = \bigcap_{k=1}^{n} A'_k\ , \qquad \forall n \in \mathbb{N},$$

[5]

3. A car accelerates from rest to 100km/h in 12 seconds.

   Find:

   i. the acceleration of the car (assumed constant)

   ii. the distance travelled by the car

4. The probability that any child in a certain family will have blue eyes is 0.25 and this feature is inherited independently by different children in the family.

   There are five children in a family.

   i. What is the probability at least one of them will have blue eyes?

   If at least one of the children has blue eyes,

   ii. What is the probability that at least 3 children have blue eyes?

5. Differentiate with respect to x,

   i. $y = x^3 \ln 2x$

   ii. $y = (x + \sin 2x)^3$

[6]

   Given that $x = \cot y$,

   iii. show that $\frac{dy}{dx} = \frac{-1}{1+x^2}$

[5]

6. The curve C, with parametric equations

$$x = 1 - \frac{1}{2}t \quad , \quad y = 2^t - 1$$

meets the x axis at the point A.

i. Find the co-ordinates of A

[2]

The region B is bounded by the curve C, the line $x = -1$, and the x axis.

ii. Use integration to find the exact area of B

[6]

7. With respect to a fixed origin O, the lines l_1 and l_2 are given by the equations:

$$l_1: \ r = (9i + 13j - 3k) + \lambda(i + 4j - 2k)$$

$$l_2: \ r = (2i - j + k) + \mu(2i + j + k)$$

where λ and μ are scalar parameters

i. Given l_1 and l_2 meet, find the position vector of their point of intersection

[5]

ii. Find the acute angle between l_1 and l_2, giving your answer in degrees to 1 decimal place.

[3]

8.

a. Find the angle between the vectors

$$\underline{u} = (1,1,0) \text{ and } \underline{v} = (0,-1,1)$$

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b. For each of the following sets of lines determine whether:

- l_1 and l_2 are parallel
- l_1 and l_2 are skew
- l_1 and l_2 intersect

If a pair of lines intersects, find the point of intersection

i.
$$l_1:\ x = 2 + 2t,\ \ y = -1 - t,\ \ z = 14 + 3t$$
$$l_2:\ x = -1 + 3s,\ \ y = 3 + s,\ \ z = 3 - 2s$$

ii.
$$l_1:\ x = 1 - 4t,\ \ y = 2 + 5t,\ \ z = -3 + t$$
$$l_2:\ x = 3 + 8s,\ \ y = 7 - 10s,\ \ z = -1 - 2s$$

iii.
$$l_1:\ x = 2 + t,\ \ y = 1 - t,\ \ z = -2 - 3t$$
$$l_2:\ x = -17 + s,\ \ y = 3 - s,\ \ z = -1 + 2s$$

9.

a. Write the complex number z in the form $p + qi$ where $p, q \in \mathbb{R}$ with

$$z = \frac{3 - 2i}{1 + 2i}$$

b. Given the complex number $z = -2 - 2i$,

- write z in modulus-argument form and in exponential form, using the principal value of the argument,
- sketch z on the Argand diagram,
- calculate z^4 and write it in the form $p + qi$ where $p, q \in \mathbb{R}$.

c. Find graphically the solutions to the inequalities

- $|z - 2 + 2i| < 2$
- $2|2 - 2i - z| \geq 2$
- Hence, solve the combined inequality

$$|z - 2 + 2i| < 2 \leq 2|2 - 2i - z|$$

[8]

10.

a. Consider the n by n matrix **Q** which is obtained from the n by n matrix **A** by multiplying the second row in A by a real number λ.
Prove that det(**Q**) = λ det(**A**).

[3]

b. Use Cramer's rule to determine the value of q where (p, q, r) is the solution of the system of linear equations

$$\begin{cases} - 3y + 2z = 2 \\ - y + 3z = -1 \\ -x - y + 5z = -1 \end{cases}$$

Do not calculate either of components p or r

[3]

c. Let V and W be two (not necessarily distinct) real vector spaces and let $T: V \to W$ be a linear transformation. Define the image of T and prove that it is a subspace of W.

[3]

d. Let $T: \mathbb{R}^2 \to \mathbb{R}^3$ be the linear transformation given by the rule

$$T(x, y) = (2x - y, 3y, 2y - 3x)$$

- Find the matrix **A** that represents T relative to the ordered bases

  $B = \{(1,1), (0,1)\},\ B' = \{(1,0,0), (1,-1,0). (1,1,1)\}$ of $\mathbb{R}^2$ and $\mathbb{R}^3$

  respectively.

- Determine the rank of T

- (iii) Determine the kernel, ker(T), and the image, im(T).

- (iv) Find a basis of im(T) and determine the nullity of T.

[8]

How to use Feedback

You will receive feedback from lots of different lecturers/post-grads, for a wide variety of subjects. It can be difficult to know how to prioritise the areas you need to work on, and how to interpret what action needs to be taken to make improvements.

Learning and revising are very personal processes that are different for each individual. There is no right or wrong way to learn/revise.

Next, we detail a few simple suggestions for interpreting feedback and putting it to use in your learning/revision. Remember, this is only a guide; find the techniques that work best for you and stick to them.

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Using feedback tips & tricks:

The feedback you are provided with should be looked at when you receive it, and, be your first point of call when starting revision, as it has been written by the people that will be setting and marking your exams. Below are some key things to do when using your feedback.

- **Use your feedback when you receive it.** This is when the problem is still fresh in your memory, so the easiest time to understand how the feedback is relevant. When it comes to revision, use the feedback as a guide to help you attempt similar sort of questions.

- **Identify your strengths/weaknesses.** The clearest guide to this will be your marks. You will score higher on areas that are your strengths. However, you still need to revise your strengths; topics you were good at during first term will need recapping in order for them to be as strong in the final examinations.

- **Take note of questions/topics that you consistently get wrong.** These are the areas that will require more focus. There are plenty of resources online that can be used to help revise the trickier areas. One very useful website is www.khanacademy.com.

- **Use the help available.** If you still don't understand how to answer a question, even after looking over the feedback, ask for help. Lecturers do not want you to fail, so are always happy to help clarify issues during their office hours. However, if you'd rather something a bit more informal there are other options available.
    - **PASS** – the PASS scheme (Peer Assisted Study Scheme) is run by older year groups and the location is timetabled each week.
    - **Mathematics Support Centre** – located on the first floor in the library; this is run by post-grads.
    - **Post-grad drop-in sessions** – located in the MLC.

  All of these sessions are designed for students to show up and ask any questions they have regarding their work. Remember, if you have a problem ask for help, sooner rather than later.

- **Always read the feedback you are given** – it sounds obvious, but if you don't read it, you won't know what you can do to improve. The lecturers spend a long time marking your work and giving guidance, if you don't read it, the whole process becomes pointless for everyone involved.

  If you don't understand the feedback you receive, ask for clarification (the sooner the better).

This is an example of a student's answer to a class test question on induction and the feedback provided. On the following page you will find the extra working the student did upon receiving their feedback to help increase their understanding.

No Calculator

6. Prove using Mathematical Induction, that $n^3 + 5n$ can be divided by 6, for all $n \in \mathbb{N}$.

[4]

$P(1)$: $(1)^3 + 5(1) = 1 + 5 = 6$ which is divisible by 6

$\therefore$ true for $P(1)$. ✓ 1

Assume true for $P(k)$:

$$\frac{k^3 + 5k}{6} = \text{an integer}$$

Then $P(k+1)$:

$$(k+1)^3 + 5(k+1) = (k+1)\left[(k+1)^2 + 5\right] = (k+1)\left[k^2 + 2k + 6\right]$$

$$= k^3 + 3k^2 + 8k + 6 = \underbrace{(k^3 + 5k)}_{\text{Divisible by 6 by induction step}} + (3k^2 + 3k + 6)$$

$\boxed{1}$

Note: this is still not a complete answer as no conclusion has been drawn. It is an example of how a student has used feedback provided to figure out a solution to a problem.

6. Prove using Mathematical Induction, that $n^3 + 5n$ can be divided by 6, for all $n \in \mathbb{N}$. [4]

$P(1)$: $(1)^3 + 5(1) = 1 + 5 = 6$ which is divisible by 6

$\therefore$ true for $P(1)$. ✓ 1

Assume true for $P(k)$:

$\frac{k^3+5k}{6}$ = an integer (call this integer p)

Then $P(k+1)$:

$(k+1)^3 + 5(k+1) = (k+1)\left[(k+1)^2 + 5\right] = (k+1)\left[k^2+2k+6\right]$

$= k^3 + 3k^2 + 8k + 6 = \underbrace{(k^3+5k)}_{\text{Divisible by 6 by induction step}} + (3k^2+3k+6)$

$= (k^3+5k) + 3(k^2+k) + 6$

by assumption

$= 6(p) + 6 + 3(k^2+k)$

$= 6(p+1) + 3(k^2+k)$ 1

but $\forall k \in \mathbb{N}$ k^2+k is even $(k^2+k = 2q,\ q \in \mathbb{N})$

$= 6(p+1) + 3(2q)$

$= 6(p+1) + 6q$

$\therefore (k+1)^3 + 5(k+1) = 6(p+1) + 6q$ which is divisible by 6

The following conclusion should be made to form a complete solution:

This holds for all k∈N.
Therefore, ∀k∈N : P(k) is true => P(k+1) is true.
Therefore, ∀n∈N, P(n) is true.

<u>**Top Ten Summary Tips for Students**</u>

1. Always read feedback
2. Discuss issues with your friends and peers
3. Don't be afraid to ask for help
4. Use Post-grad drop-in sessions
5. Attend PASS Scheme sessions
6. Don't forget about the Mathematics Support Centre
7. Lecturers are always happy to help in office hours
8. Identify strengths/weaknesses
9. Re-attempt difficult questions
10. Don't leave work until the last minute

Tips & Tricks for getting the most out of Canvas

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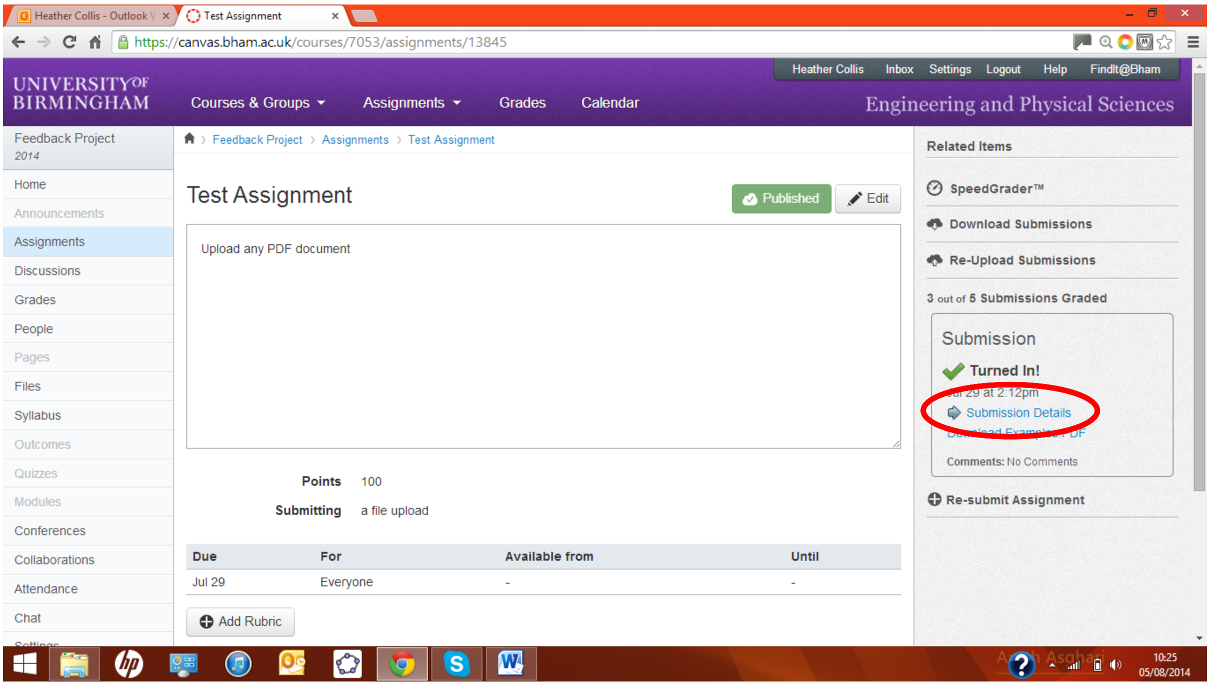
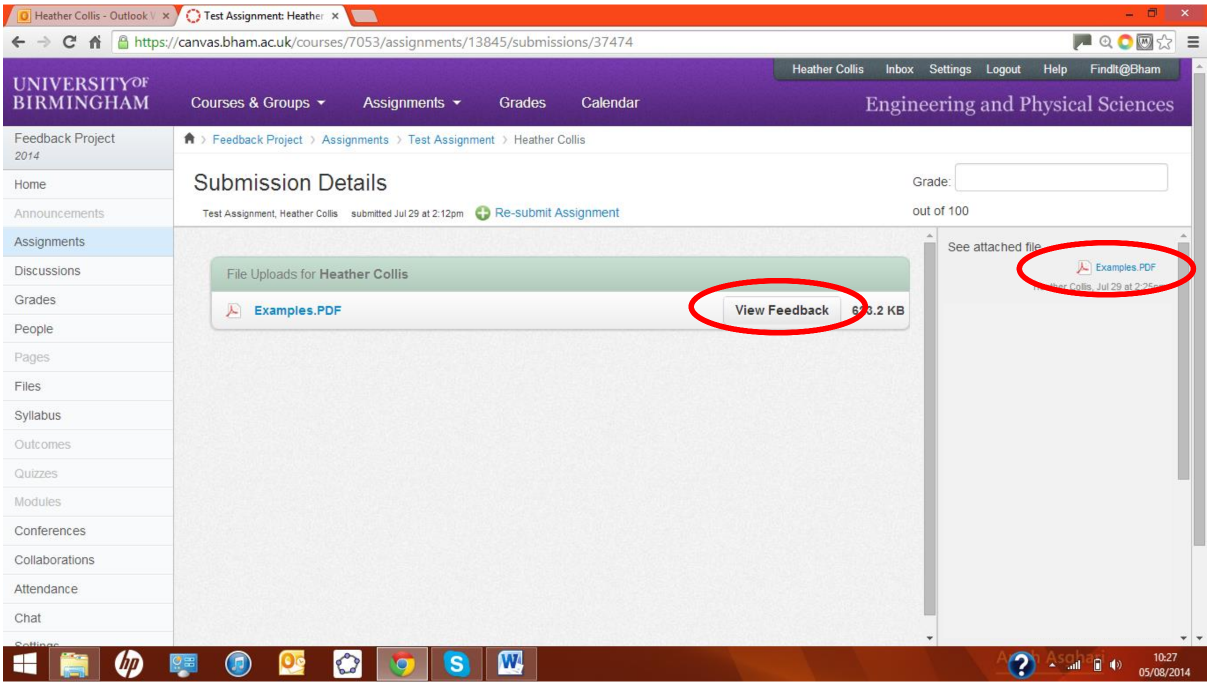
Accessing Online Submissions Feedback

To access feedback for your online submissions, go to the assignments tab. From here, select the assignment you wish to view feedback for.

Now select “Submission Details”.



From here you can view feedback in an online preview mode, or download the marked file.



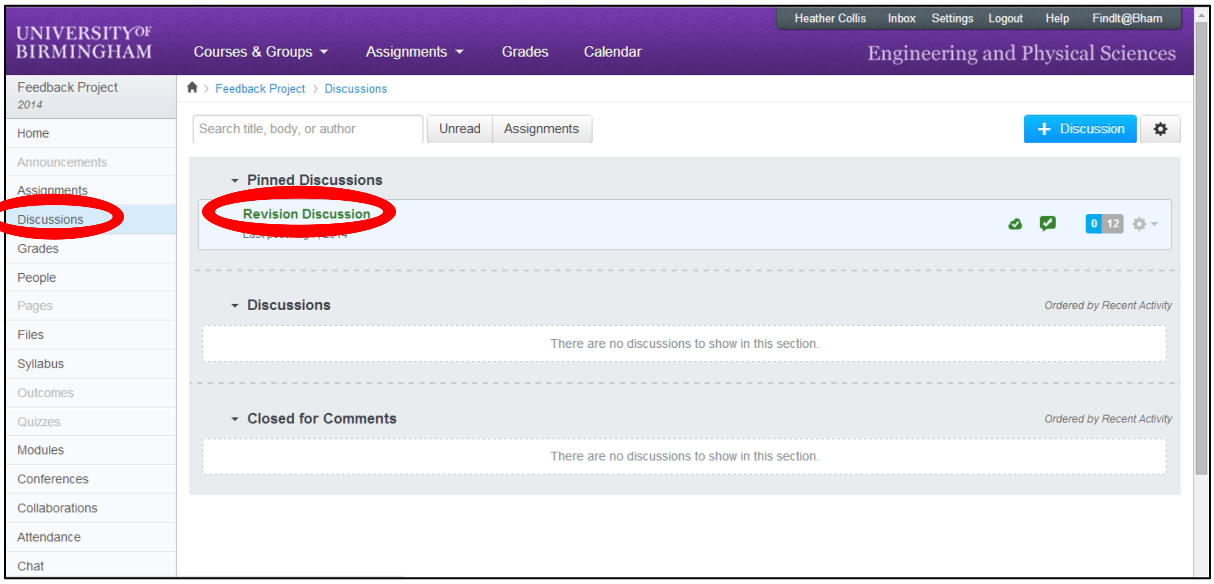
Group Discussions

Some people find being able to discuss their work very useful. Many older students have found ways of doing this through Facebook groups/chats. However, there is a feature on Canvas that will make this very easy.

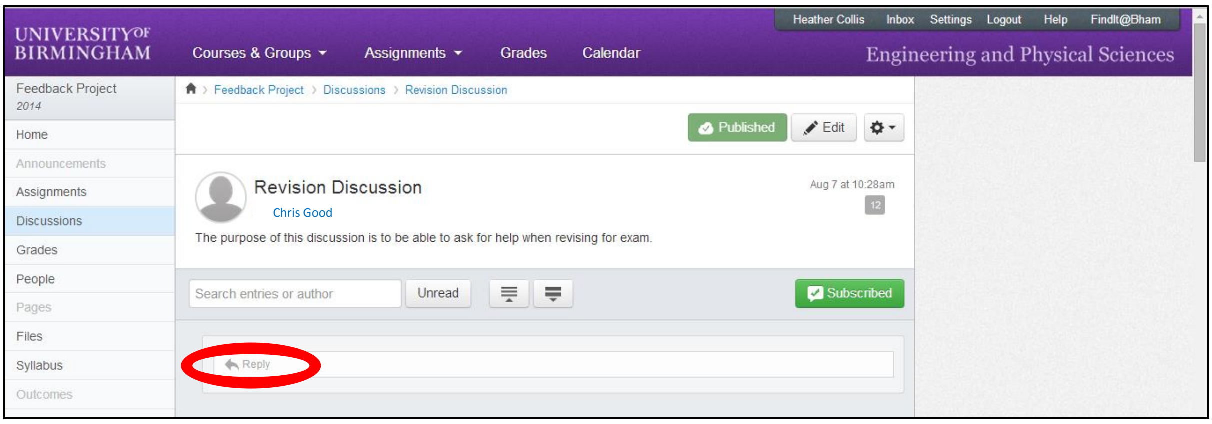
The discussions feature can be used to post questions to everyone on your course, it sounds intimidating but it really isn't. If you are struggling with something, there are bound to be people in a similar situation. The discussions feature allows you to pick the minds of your peers to try and come up with your own solution to a question. There will be plenty of people happy to help answer questions; especially as being able to answer someone else's question will force them to revise the topic themselves. You can also insert equations into the discussions feature, so it is much easier to write mathematics on.

Below is a guide showing where to find the discussions feature, along with some examples of the types of questions students ask and the responses they get.

To access a discussion, open the discussions tab and select the appropriate discussion.



From here, you can ask a question by posting a reply.



Below are examples of questions and responses:

Heather
10:58am
What's the definition of a free variable in Buckingham Pi?
Reply

Mano
11:00am
it's basically when one of the powers can take any value, the one that you write the others in terms of :)
Reply

Heather
11:00am
Thanks :)
Reply

Mano
11:01am
when do you use SUVAT and when do you use integration?
Reply

Heather
11:02am
Suvat is for constant acceleration, integration for variable acceleration
Reply

Mano
11:02am
define constant acceleration
Reply

Heather
11:03am
velocity changes the same amount each second

Heather
11:07am
I can't seem to get the particular integral of this to work: $y'' - 4y' + 4y = xe^x$
Any ideas?
Reply

Heather
11:09am
Got my CF to be $y = (A + Bx)\,e^{2x}$ so shouldn't the PI be of the form $y = C\,(x^2)\,e^x$?
Reply

Mano
11:12am
Thats the evil question, your test function is $(Ax + B)\,e^x$for the PI. The answer is $(x + 2)\,e^x$(or minus can't remember)
Reply

Agata
11:14am
It will be in the form $(C + Dx)\,e^x$. Exponentials to different powers don't bother each other
Reply

Heather
11:16am
oh snap, it's a different power, I'm a bit of a fail :/
Reply