Section 5-1 : Indefinite Integrals

1. Evaluate each of the following indefinite integrals.

(a) $\int 6x^5 - 18x^2 + 7\,dx$

(b) $\int 6x^5\,dx - 18x^2 + 7$

Hint : As long as you recall your derivative rules and the fact that all this problem is really asking is the for us to determine the function that we differentiated to get the integrand (*i.e*. the function inside the integral….) this problem shouldn't be too difficult.

(a) $\int 6x^5 - 18x^2 + 7\,dx$

All we are being asked to do here is "undo" a differentiation and if you recall the basic differentiation rules for polynomials this shouldn't be too difficult. As we saw in the notes for this section all we really need to do is increase the exponent by one (so upon differentiation we get the correct exponent) and then fix up the coefficient to make sure that we will get the correct coefficient upon differentiation.

Here is the answer for this part.

$$\int 6x^5 - 18x^2 + 7\,dx = \boxed{x^6 - 6x^3 + 7x + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

Also, don't forget that you can easily check your answer by differentiating your answer and making sure that the result is the same as the integrand.

(b) $\int 6x^5\,dx - 18x^2 + 7$

This part is not really all that different from the first part. The only difference is the placement of the *dx*. Recall that one of the things that the *dx* tells us where to end the integration. So, in the part we are only going to integrate the first term.

Here is the answer for this part.

$$\int 6x^5\,dx - 18x^2 + 7 = \boxed{x^6 + c - 18x^2 + 7}$$

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2. Evaluate each of the following indefinite integrals.

(a) $\int 40x^3 + 12x^2 - 9x + 14\,dx$

(b) $\int 40x^3 + 12x^2 - 9x\,dx + 14$

(c) $\int 40x^3 + 12x^2 \, dx - 9x + 14$

Hint : As long as you recall your derivative rules and the fact that all this problem is really asking is the for us to determine the function that we differentiated to get the integrand (*i.e*. the function inside the integral….) this problem shouldn't be too difficult.

(a) $\int 40x^3 + 12x^2 - 9x + 14 \, dx$

All we are being asked to do here is "undo" a differentiation and if you recall the basic differentiation rules for polynomials this shouldn't be too difficult. As we saw in the notes for this section all we really need to do is increase the exponent by one (so upon differentiation we get the correct exponent) and then fix up the coefficient to make sure that we will get the correct coefficient upon differentiation.

Here is that answer for this part.

$$\int 40x^3 + 12x^2 - 9x + 14 \, dx = \boxed{10x^4 + 4x^3 - \tfrac{9}{2}x^2 + 14x + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

Also, don't forget that you can easily check your answer by differentiating your answer and making sure that the result is the same as the integrand.

(b) $\int 40x^3 + 12x^2 - 9x \, dx + 14$

This part is not really all that different from the first part. The only difference is the placement of the *dx*. Recall that one of the things that the *dx* tells us where to end the integration. So, in the part we are only going to integrate the first term.

Here is the answer for this part.

$$\int 40x^3 + 12x^2 - 9x \, dx + 14 = \boxed{10x^4 + 4x^3 - \tfrac{9}{2}x^2 + c + 14}$$

(c) $\int 40x^3 + 12x^2 \, dx - 9x + 14$

The only difference between this part and the previous part is that the location of the *dx* moved.

Here is the answer for this part.

$$\int 40x^3 + 12x^2 \, dx - 9x + 14 = \boxed{10x^4 + 4x^3 + c - 9x + 14}$$

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3. Evaluate $\int 12t^7 - t^2 - t + 3 \, dt$.

Hint : As long as you recall your derivative rules and the fact that all this problem is really asking is the for us to determine the function that we differentiated to get the integrand (*i.e*. the function inside the integral….) this problem shouldn't be too difficult.

Solution

All we are being asked to do here is "undo" a differentiation and if you recall the basic differentiation rules for polynomials this shouldn't be too difficult. As we saw in the notes for this section all we really need to do is increase the exponent by one (so upon differentiation we get the correct exponent) and then fix up the coefficient to make sure that we will get the correct coefficient upon differentiation.

Here is the answer.

$$\int 12t^7 - t^2 - t + 3\,dt = \boxed{\tfrac{3}{2}t^8 - \tfrac{1}{3}t^3 - \tfrac{1}{2}t^2 + 3t + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

Also, don't forget that you can easily check your answer by differentiating your answer and making sure that the result is the same as the integrand.

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4. Evaluate $\int 10w^4 + 9w^3 + 7w\;dw$.

Hint : As long as you recall your derivative rules and the fact that all this problem is really asking is the for us to determine the function that we differentiated to get the integrand (*i.e*. the function inside the integral….) this problem shouldn't be too difficult.

Solution

All we are being asked to do here is "undo" a differentiation and if you recall the basic differentiation rules for polynomials this shouldn't be too difficult. As we saw in the notes for this section all we really need to do is increase the exponent by one (so upon differentiation we get the correct exponent) and then fix up the coefficient to make sure that we will get the correct coefficient upon differentiation.

Here is the answer.

$$\int 10w^4 + 9w^3 + 7w\;dw = \boxed{2w^5 + \tfrac{9}{4}w^4 + \tfrac{7}{2}w^2 + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

Also, don't forget that you can easily check your answer by differentiating your answer and making sure that the result is the same as the integrand.

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5. Evaluate $\int z^6 + 4z^4 - z^2 \, dz$.

Hint : As long as you recall your derivative rules and the fact that all this problem is really asking is the for us to determine the function that we differentiated to get the integrand (*i.e*. the function inside the integral….) this problem shouldn't be too difficult.

Solution
All we are being asked to do here is "undo" a differentiation and if you recall the basic differentiation rules for polynomials this shouldn't be too difficult. As we saw in the notes for this section all we really need to do is increase the exponent by one (so upon differentiation we get the correct exponent) and then fix up the coefficient to make sure that we will get the correct coefficient upon differentiation.

Here is the answer.

$$\int z^6 + 4z^4 - z^2 \, dz = \boxed{\tfrac{1}{7}z^7 + \tfrac{4}{5}z^5 - \tfrac{1}{3}z^3 + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

Also, don't forget that you can easily check your answer by differentiating your answer and making sure that the result is the same as the integrand.

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6. Determine $f(x)$ given that $f'(x) = 6x^8 - 20x^4 + x^2 + 9$.

Hint : Remember that all indefinite integrals are asking us to do is "undo" a differentiation.

Solution
We know that indefinite integrals are asking us to undo a differentiation to so all we are really being asked to do here is evaluate the following indefinite integral.

$$f(x) = \int f'(x) \, dx = \int 6x^8 - 20x^4 + x^2 + 9 \, dx = \boxed{\tfrac{2}{3}x^9 - 4x^5 + \tfrac{1}{3}x^3 + 9x + c}$$

Don't forget the "+c"! Remember that the original function may have had a constant on it and the "+c" is there to remind us of that.

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7. Determine $h(t)$ given that $h'(t) = t^4 - t^3 + t^2 + t - 1$.

Hint : Remember that all indefinite integrals are asking us to do is "undo" a differentiation.

Solution

We know that indefinite integrals are asking us to undo a differentiation to so all we are really being asked to do here is evaluate the following indefinite integral.

$$h(t) = \int h'(t)\,dt = \int t^4 - t^3 + t^2 + t - 1\,dt = \boxed{\tfrac{1}{5}t^5 - \tfrac{1}{4}t^4 + \tfrac{1}{3}t^3 + \tfrac{1}{2}t^2 - t + c}$$

Don’t forget the “+c”! Remember that the original function may have had a constant on it and the “+c” is there to remind us of that.