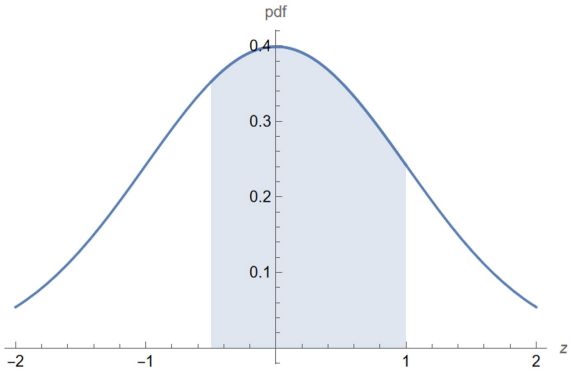
2023 Specialist Mathematics Question 6 part (b) - Further calculations

Friday, 3 November 2023 7:03 PM

```
Probability[-1/2<Z<1,Z≃NormalDistribution[0,1]]
NProbability[-1/2<Z<1,Z≃NormalDistribution[0,1]]
```

$$\frac{1}{2}\left(\text{Erf}\left[\frac{1}{2\sqrt{2}}\right]+\text{Erf}\left[\frac{1}{\sqrt{2}}\right]\right)$$

0.532807



There are infinitely many solutions to $\Pr(a < Z < b) = \frac{1}{2}\left(\text{Erf}\left[\frac{1}{2\sqrt{2}}\right]+\text{Erf}\left[\frac{1}{\sqrt{2}}\right]\right)$ (including $a = -1$ and $b = \frac{1}{2}$).

For example:

```
Clear[a]
Solve[Probability[-∞<X<a,X≃NormalDistribution[0,1]]==1/2 (Erf[1/(2 Sqrt[2])]+Erf[1/Sqrt[2]]),a]
NSolve[Probability[-∞<X<a,X≃NormalDistribution[0,1]]==0.5328072073425567,a]
```

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

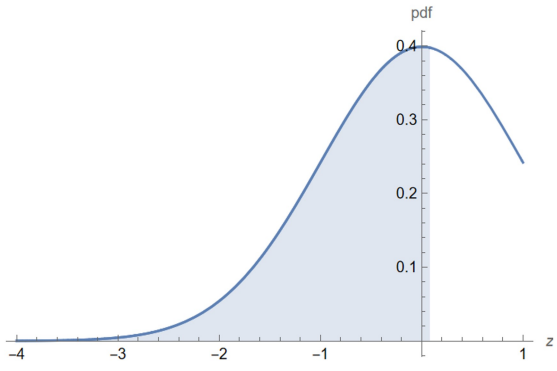
$$\left\{\left\{a \to \sqrt{2}\ \text{InverseErf}\left[-1+\text{Erf}\left[\frac{1}{2\sqrt{2}}\right]+\text{Erf}\left[\frac{1}{\sqrt{2}}\right]\right]\right\}\right\}$$

NSolve: Inverse functions are being used by NSolve, so some solutions may not be found; use Reduce for complete solution information.

$$\{\{a \to 0.0823284\}\}$$

```
Sqrt[2] InverseErf[-1+Erf[1/(2 Sqrt[2])]+Erf[1/Sqrt[2]]]//N
```

0.0823284



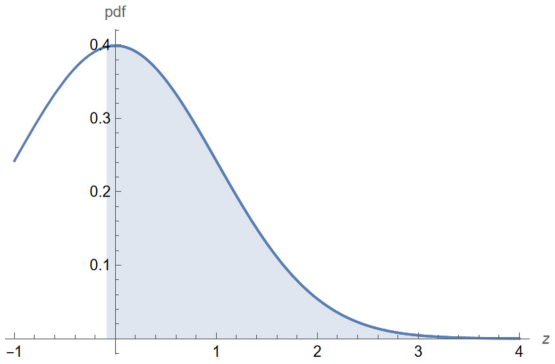
```
Clear[a]
Solve[Probability[a<X<∞,X≈NormalDistribution[0,1]]==1/2 (Erf[1/(2 √2)]+Erf[1/√2]),a]
NSolve[Probability[a<X<∞,X≈NormalDistribution[0,1]]==0.5328072073425567,a]
```

Solve: Inverse functions are being used by Solve, so some solutions may not be found; use Reduce for complete solution information.

$$\left\{\left\{a \to \sqrt{2}\ \text{InverseErfc}\left[\text{Erf}\left[\frac{1}{2\sqrt{2}}\right] + \text{Erf}\left[\frac{1}{\sqrt{2}}\right]\right]\right\}\right\}$$

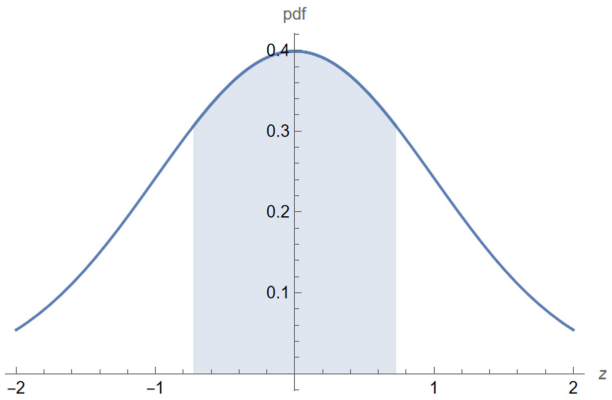
NSolve: Inverse functions are being used by NSolve, so some solutions may not be found; use Reduce for complete solution information.

$$\{\{a \to -0.0823284\}\}$$



:=
```
Clear[a]
Solve[Probability[-a<X<a,X≈NormalDistribution[0,1]]==1/2 (Erf[1/(2 √2)]+Erf[1/√2]),a]
NSolve[Probability[-a<X<a,X≈NormalDistribution[0,1]]==0.5328072073425567,a]
```

]=
$$\left\{\left\{a \to \sqrt{2}\ \text{InverseErf}\left[\frac{1}{2}\left(\text{Erf}\left[\frac{1}{2\sqrt{2}}\right] + \text{Erf}\left[\frac{1}{\sqrt{2}}\right]\right)\right]\right\}\right\}$$

NSolve: NSolve was unable to solve the system with inexact coefficients. The answer was obtained by solving a corresp

]=
$$\{\{a \to 0.727054\}\}$$